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Al-Amri

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(54) SYSTEM AND METHODS FOR RECYCLING HEAT AND WATER IN A STEAM PRESS MACHINE

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(51) **Int. Cl.**
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F28B 3/06 (2006.01)

(52) **U.S. Cl.**
CPC ***D06F 71/34*** (2013.01); ***F28B 3/06*** (2013.01)

(58) **Field of Classification Search**
CPC D06F 71/34; D06F 71/00; D06F 71/36; D06F 71/18–20; F28B 3/00; F28B 3/06
See application file for complete search history.

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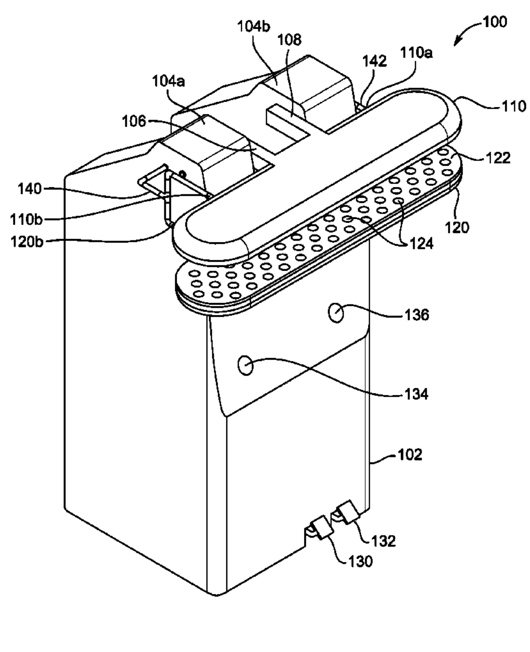
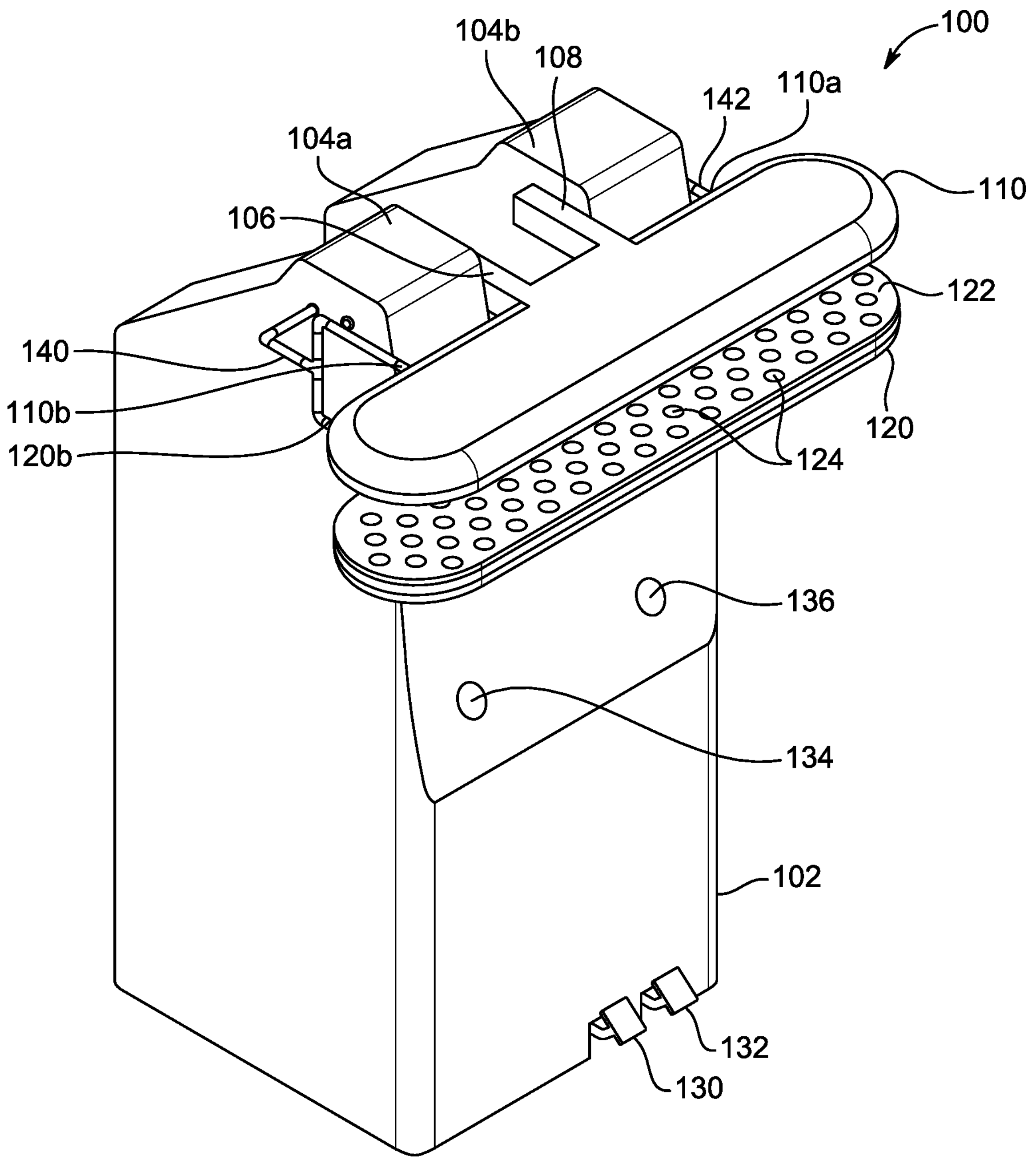
(57) **ABSTRACT**

A steam press system and methods of controlling steam generation and recycling steam therein are provided. The steam press system includes a first steam plate and a second steam plate configured to receive and evacuate steam. The steam press system further includes a first pump configured to draw steam from the first steam plate and the second steam plate, a heat exchanger configured to condense the steam into fresh water and heat the fresh water. The steam press system further includes a third pump to pump the heated water into a storage tank. The steam press system further includes a fourth pump configured to pump the heated water from the storage tank to a steam generator. The steam generator is configured to receive the heated water, boil the heated water to generate steam and to deliver the steam to the first steam plate and the second steam plate.

20 Claims, 17 Drawing Sheets

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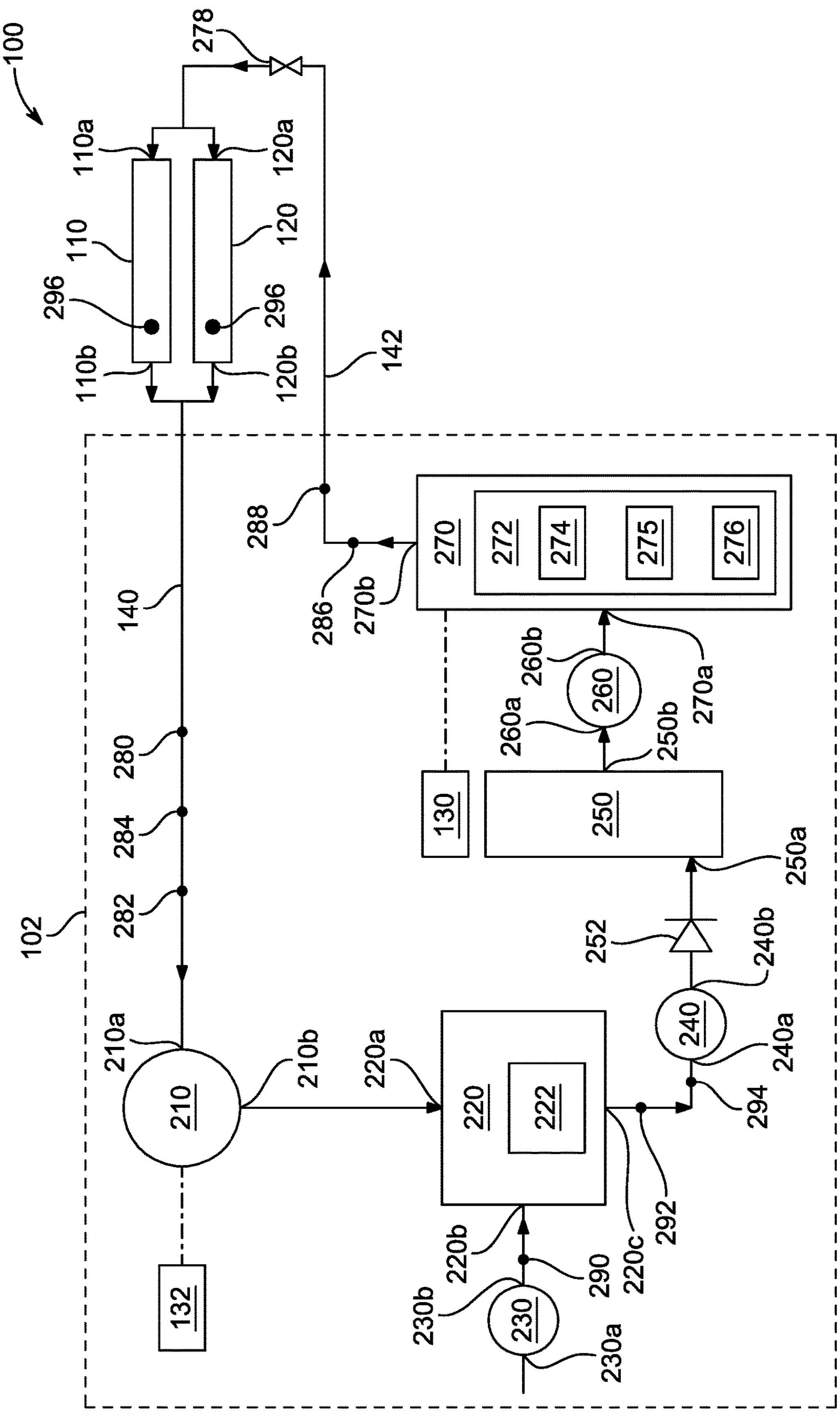
130

FIG. 1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240
240a
294
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210b
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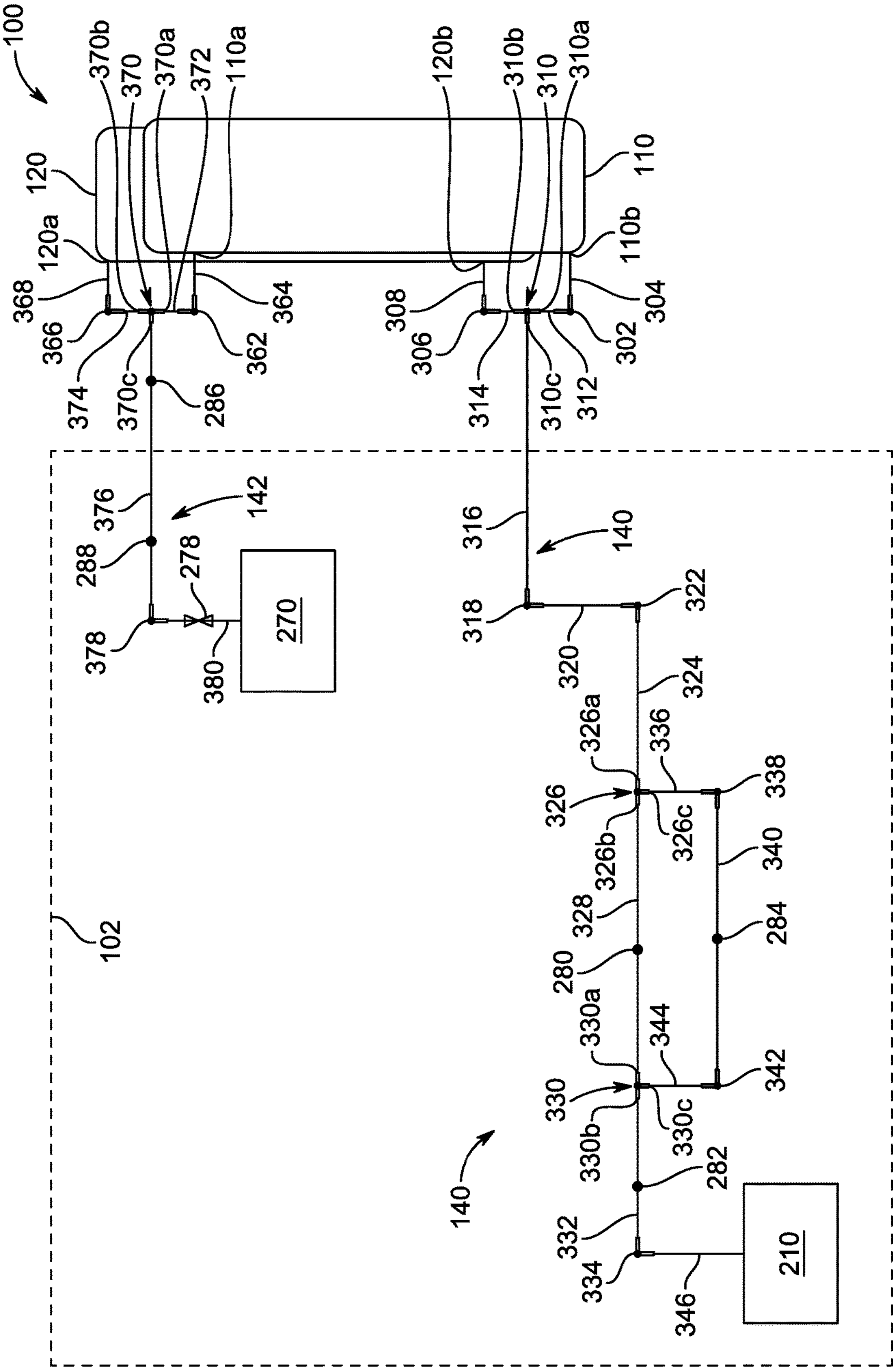
222
292
220c
220b
290
230b
230
230a
132

FIG. 2



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370a
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120a
110b
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304
366
362
306
302
374
370c
286
314
310c
312
376
142
316
140
288
278
270
318
322
378
380
320
324
326a
336
326
338
326c
326b
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330c
330b
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210
334
346
102

FIG. 3

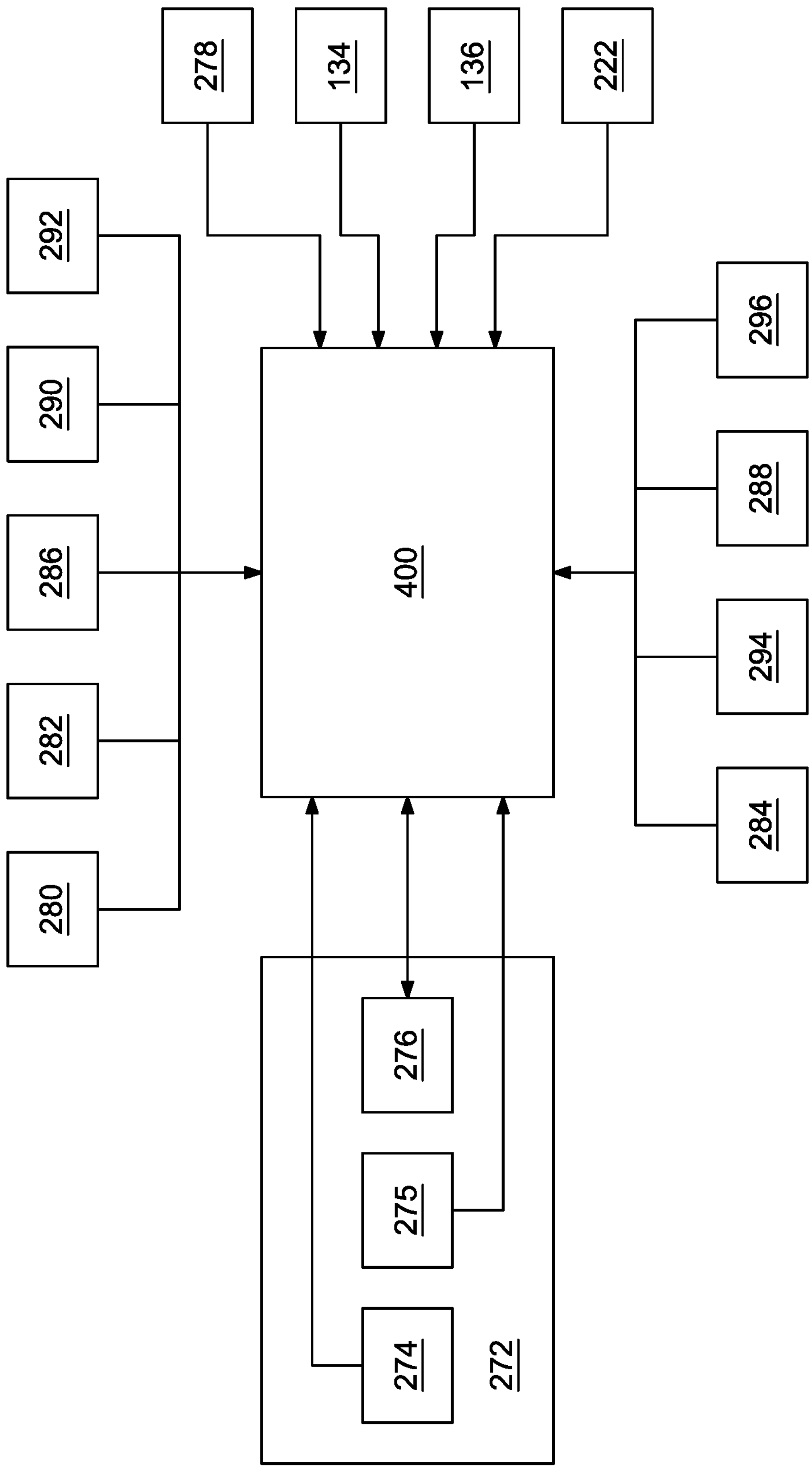
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FIG. 4

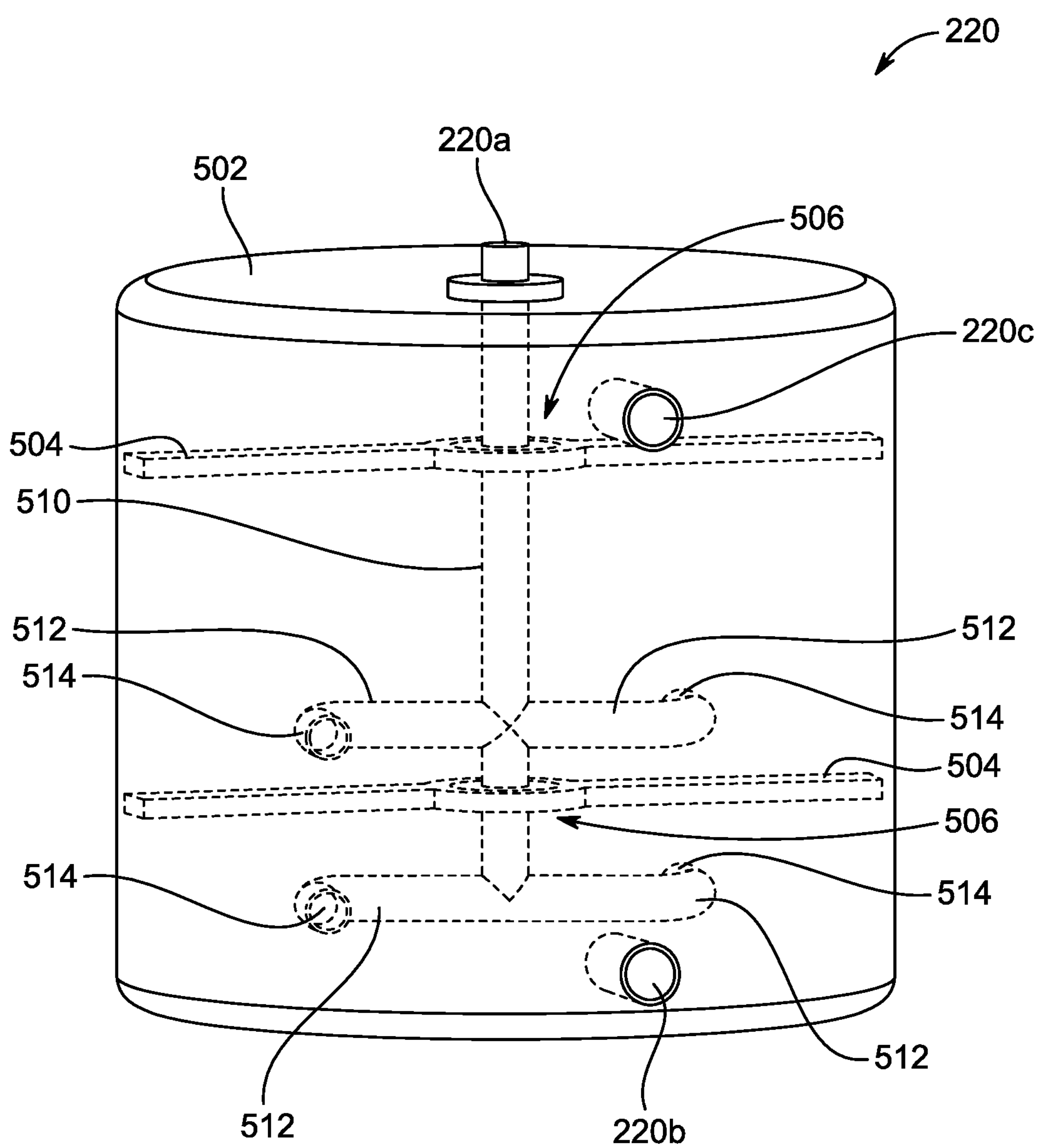
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FIG. 5

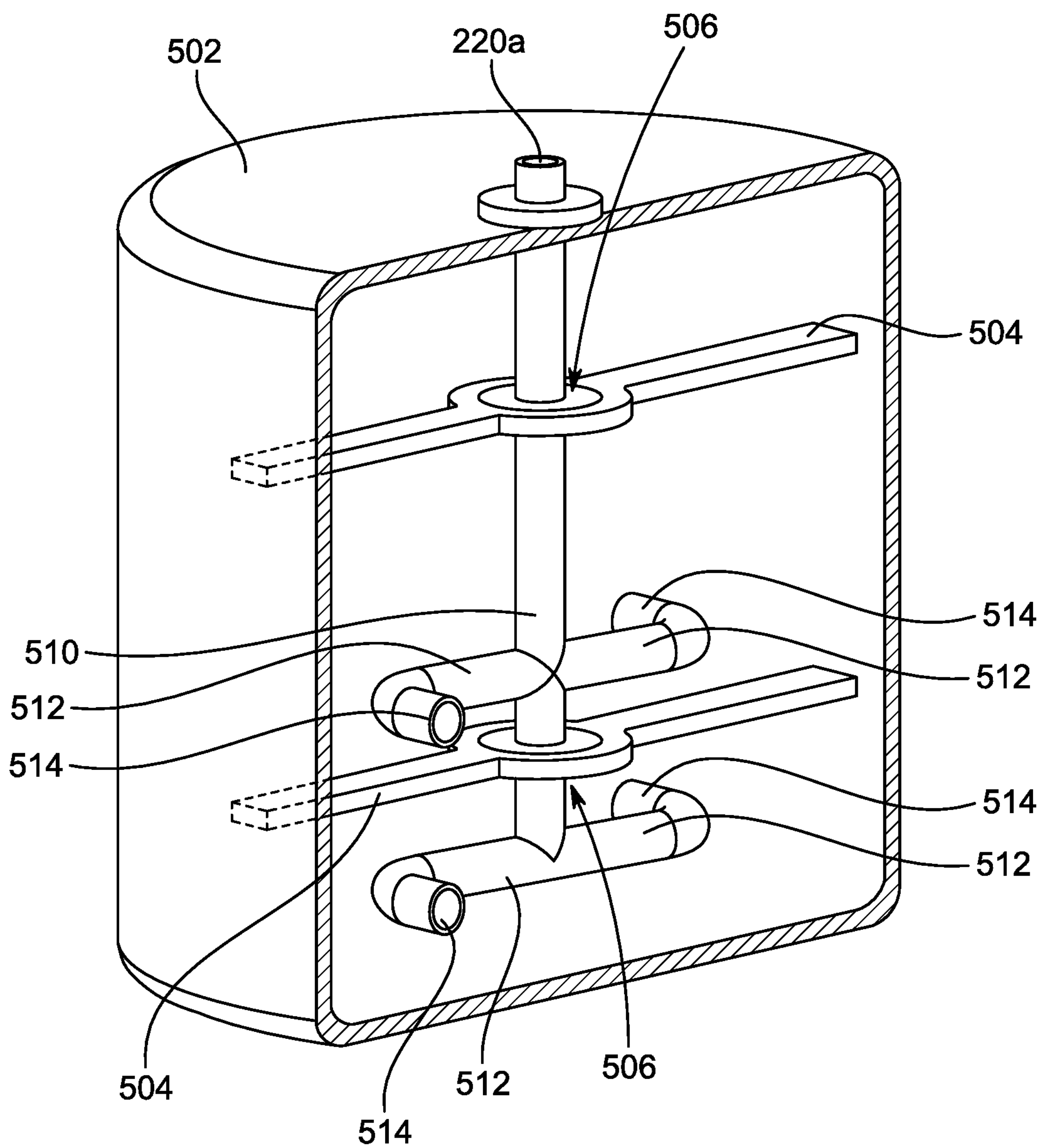
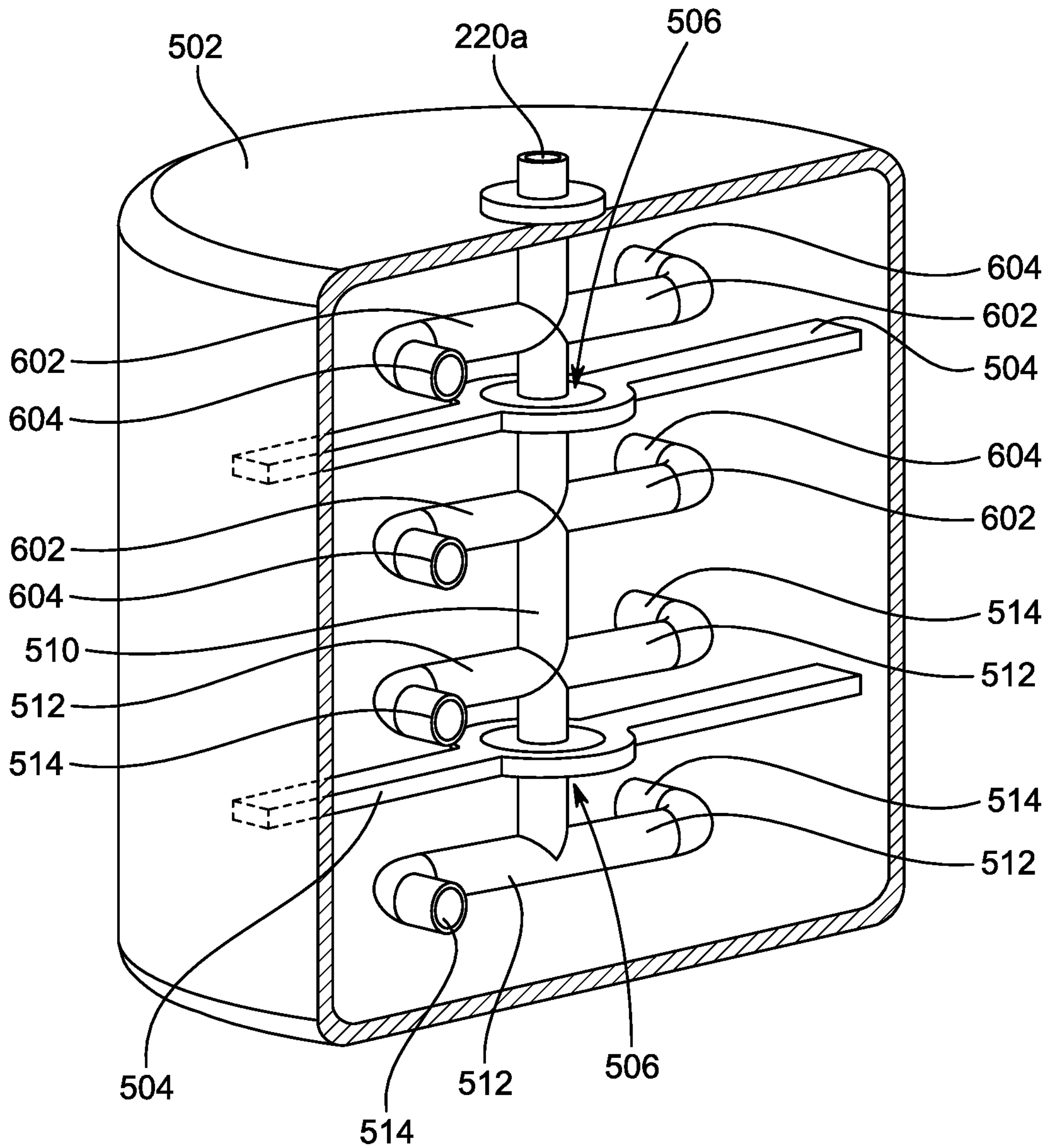


FIG. 6A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506

FIG. 6B

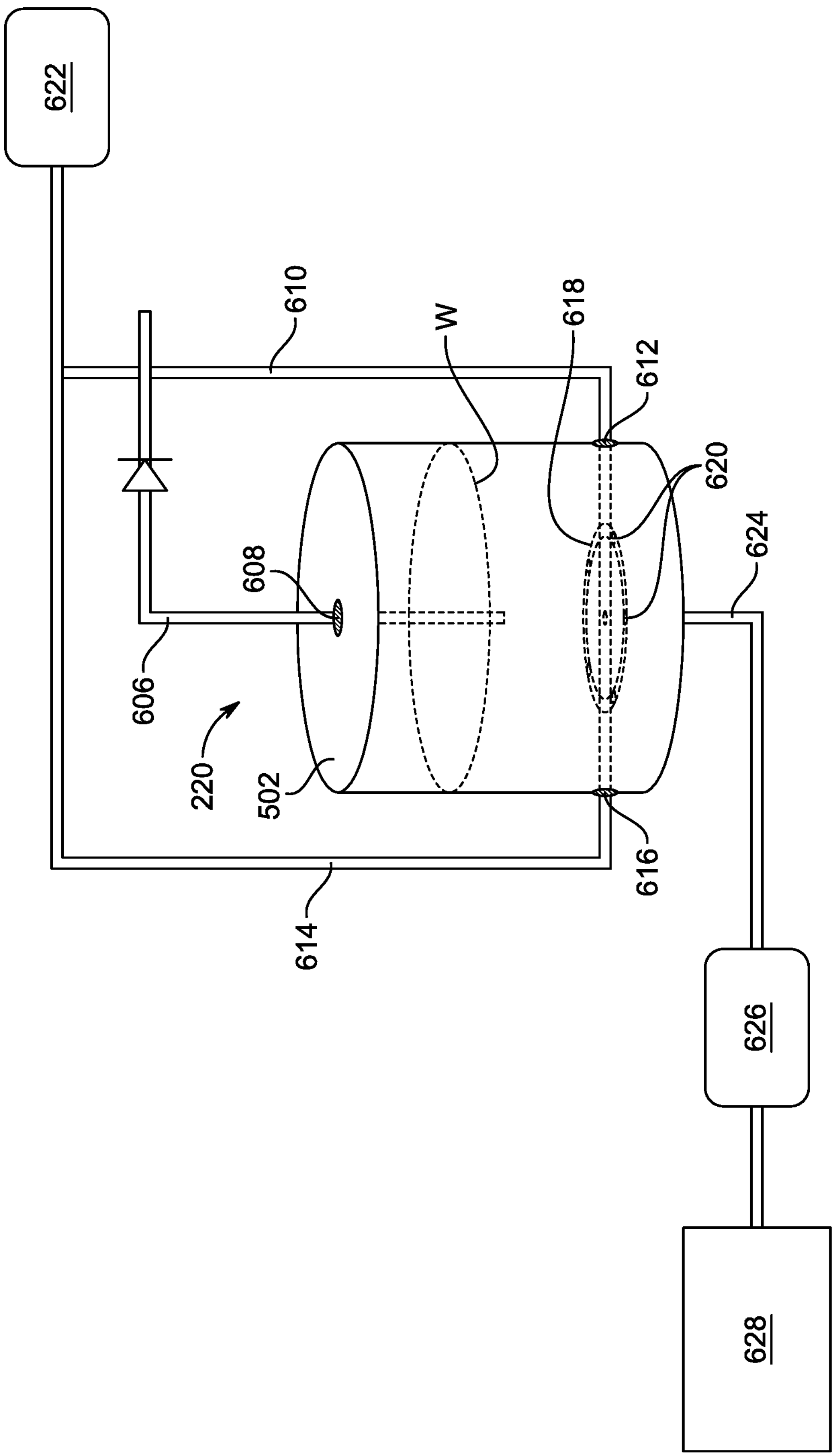


FIG. 6C

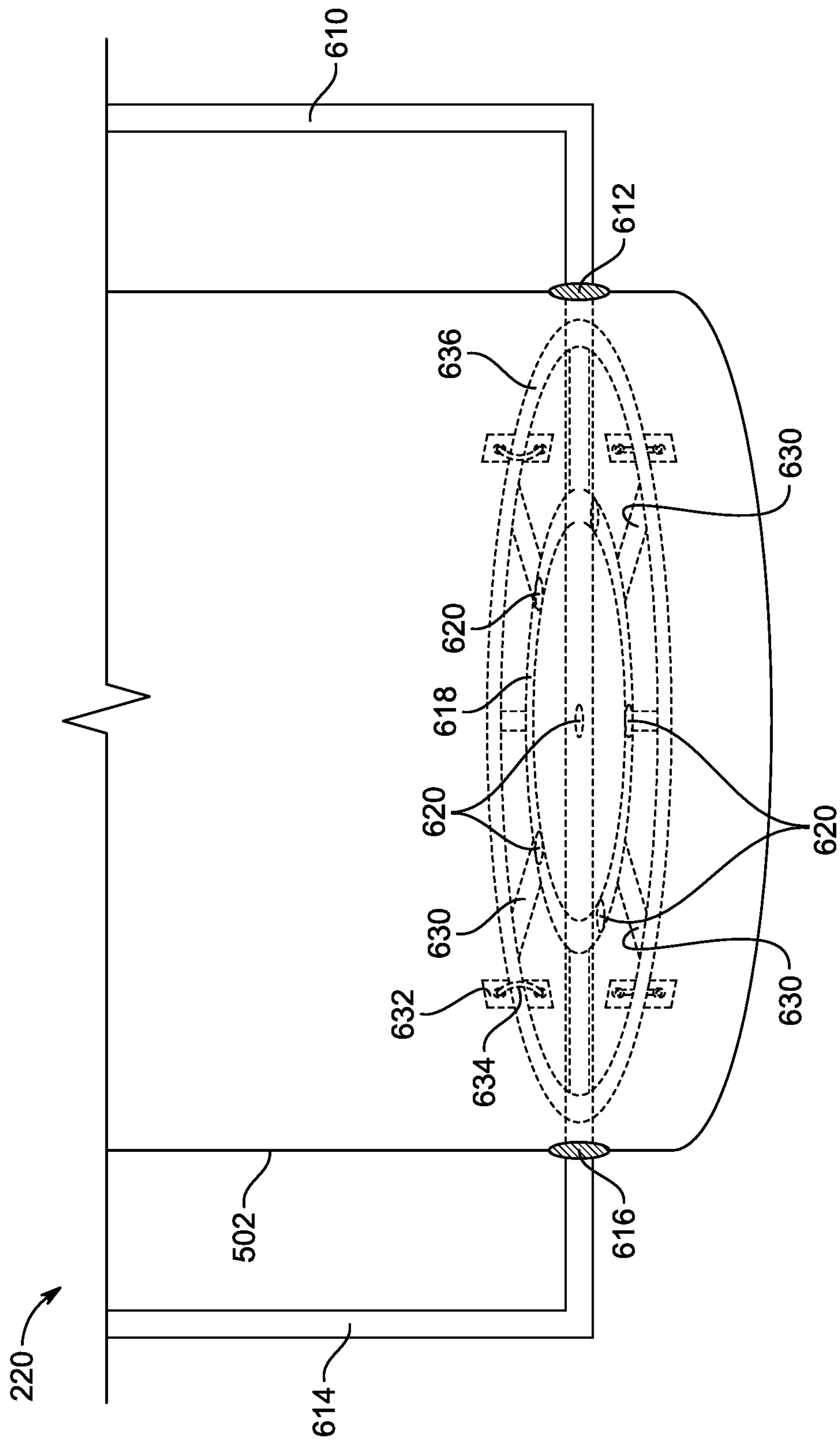


FIG. 6D

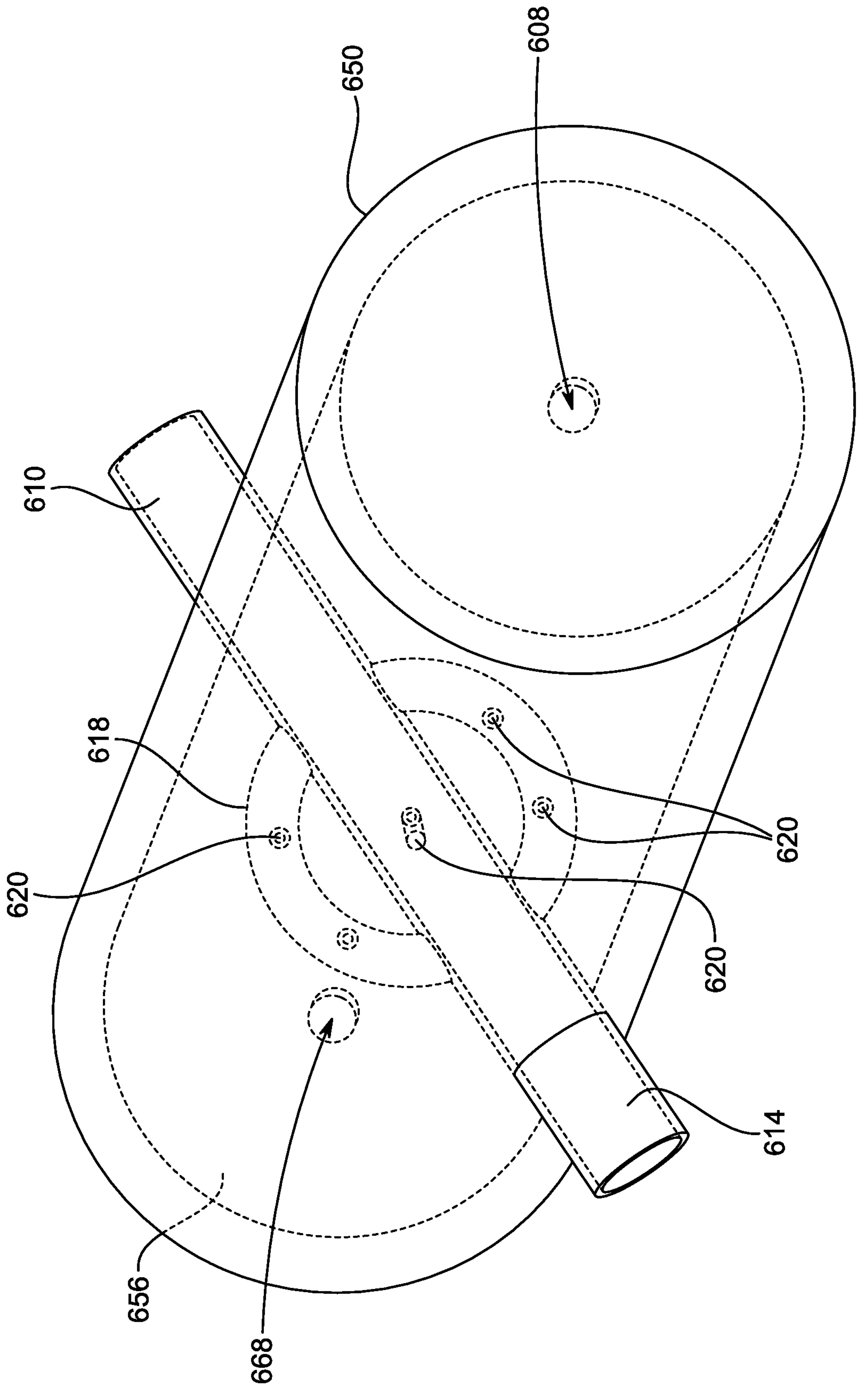


FIG. 6E

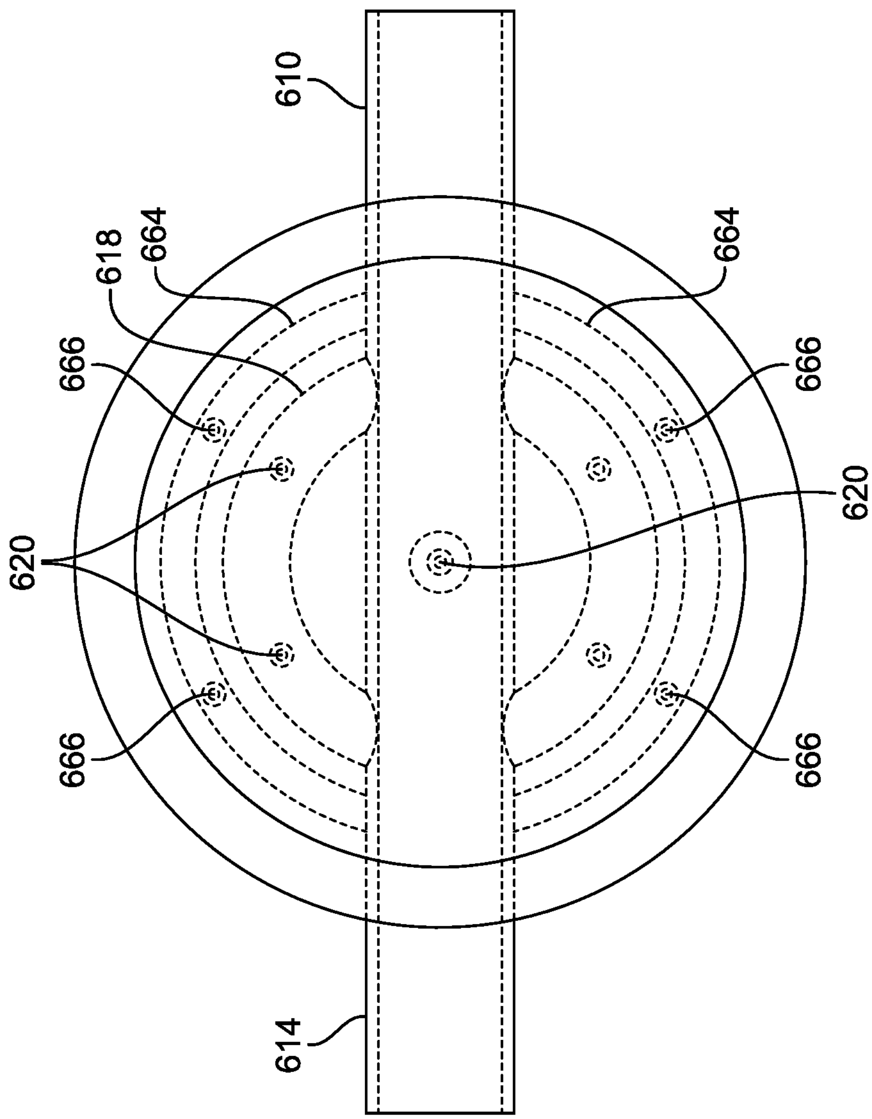


FIG. 6F

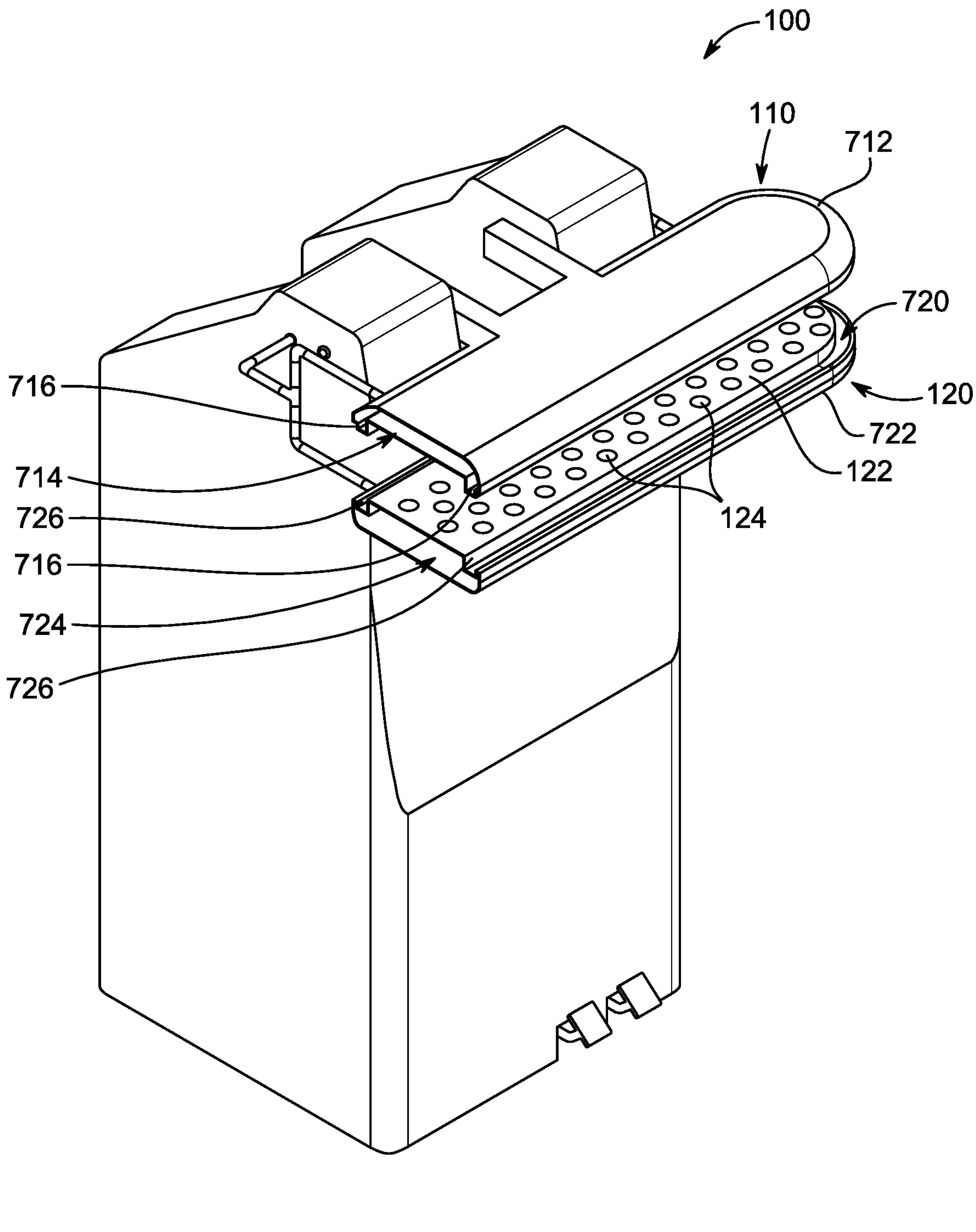
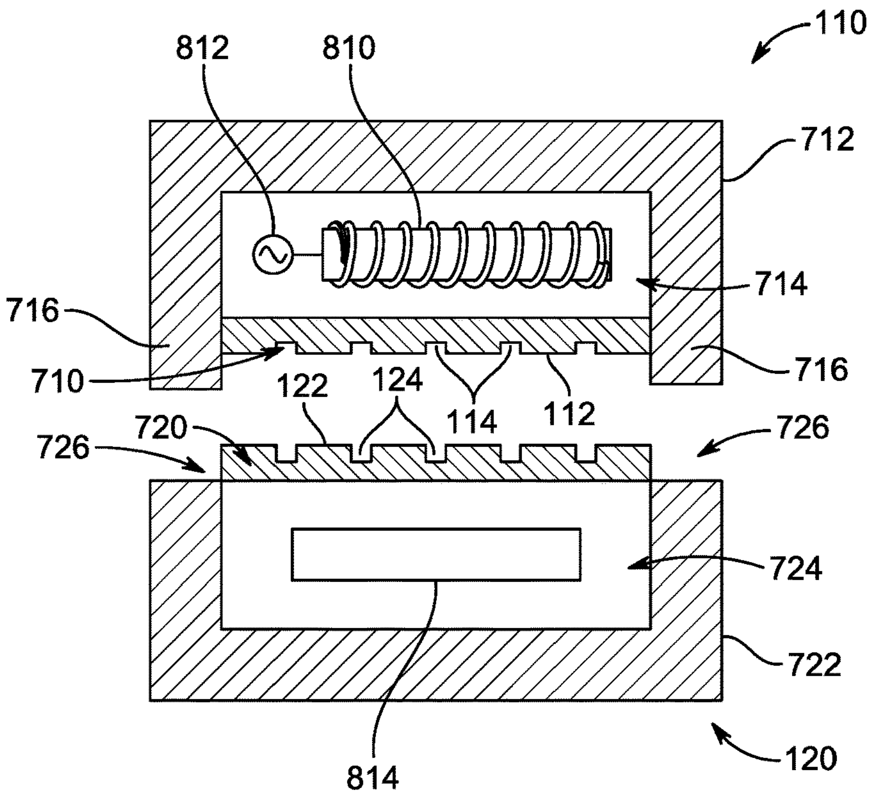


FIG. 7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712
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710
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114
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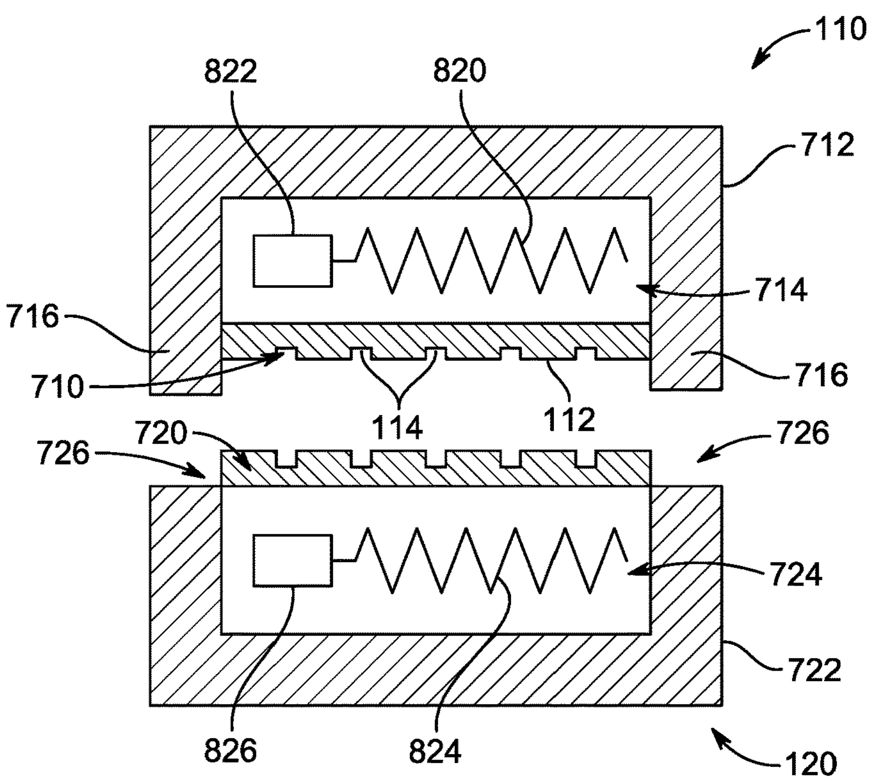
720
726
726
724
722
814
120

FIG. 8A


110
822
820
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714
716
710
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114
112
720
726
726
724
722
826
824
120

FIG. 8B

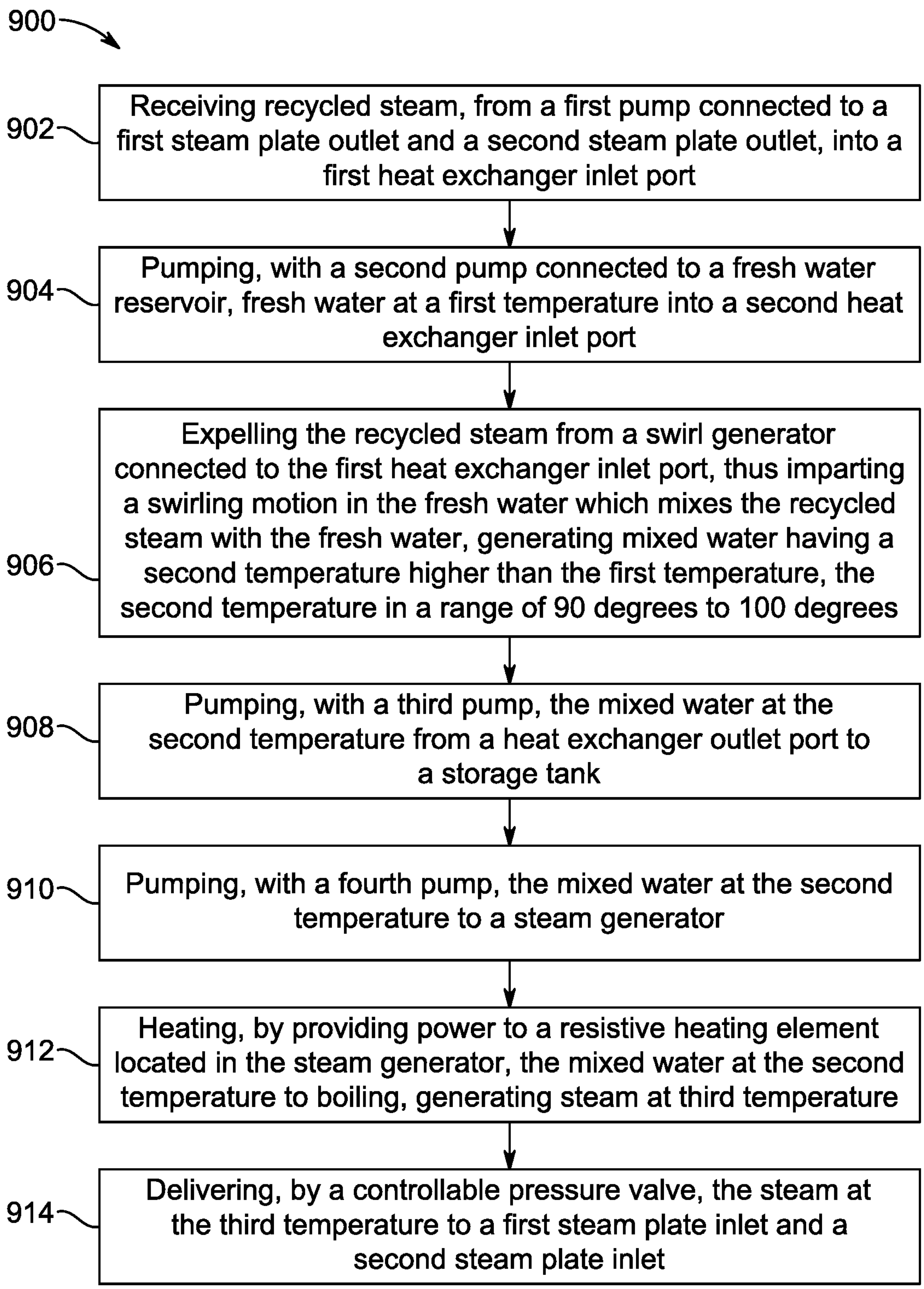

900
902
Receiving recycled steam, from a first pump connected to a first steam plate outlet and a second steam plate outlet, into a first heat exchanger inlet port
904
Pumping, with a second pump connected to a fresh water reservoir, fresh water at a first temperature into a second heat exchanger inlet port
906
Expelling the recycled steam from a swirl generator connected to the first heat exchanger inlet port, thus imparting a swirling motion in the fresh water which mixes the recycled steam with the fresh water, generating mixed water having a second temperature higher than the first temperature, the second temperature in a range of 90 degrees to 100 degrees
908
Pumping, with a third pump, the mixed water at the second temperature from a heat exchanger outlet port to a storage tank
910
Pumping, with a fourth pump, the mixed water at the second temperature to a steam generator
912
Heating, by providing power to a resistive heating element located in the steam generator, the mixed water at the second temperature to boiling, generating steam at third temperature
914
Delivering, by a controllable pressure valve, the steam at the third temperature to a first steam plate inlet and a second steam plate inlet

FIG. 9

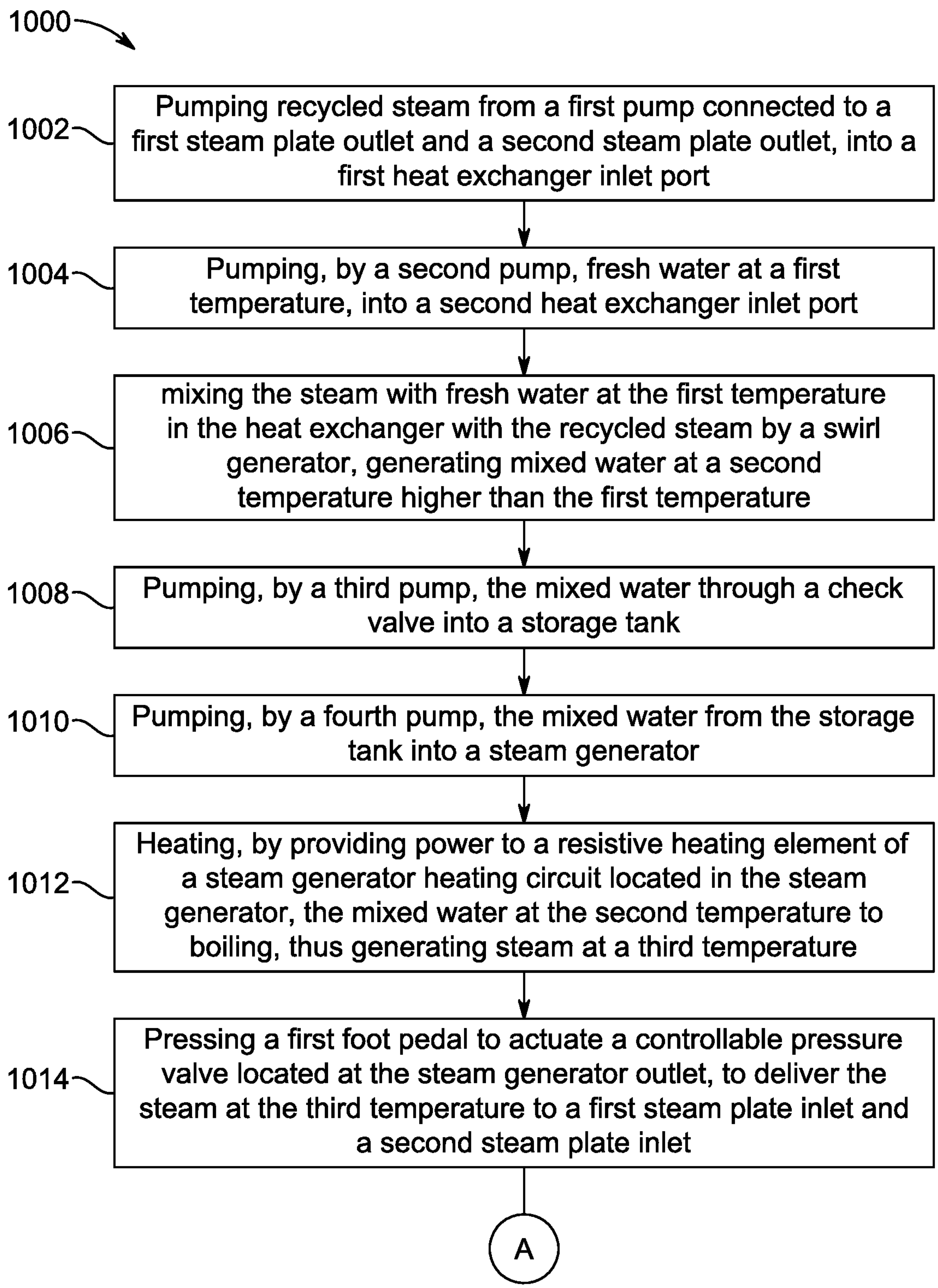

1000
1002
Pumping recycled steam from a first pump connected to a first steam plate outlet and a second steam plate outlet, into a first heat exchanger inlet port
1004
Pumping, by a second pump, fresh water at a first temperature, into a second heat exchanger inlet port
1006
mixing the steam with fresh water at the first temperature in the heat exchanger with the recycled steam by a swirl generator, generating mixed water at a second temperature higher than the first temperature
1008
Pumping, by a third pump, the mixed water through a check valve into a storage tank
1010
Pumping, by a fourth pump, the mixed water from the storage tank into a steam generator
1012
Heating, by providing power to a resistive heating element of a steam generator heating circuit located in the steam generator, the mixed water at the second temperature to boiling, thus generating steam at a third temperature
1014
Pressing a first foot pedal to actuate a controllable pressure valve located at the steam generator outlet, to deliver the steam at the third temperature to a first steam plate inlet and a second steam plate inlet
A

FIG. 10

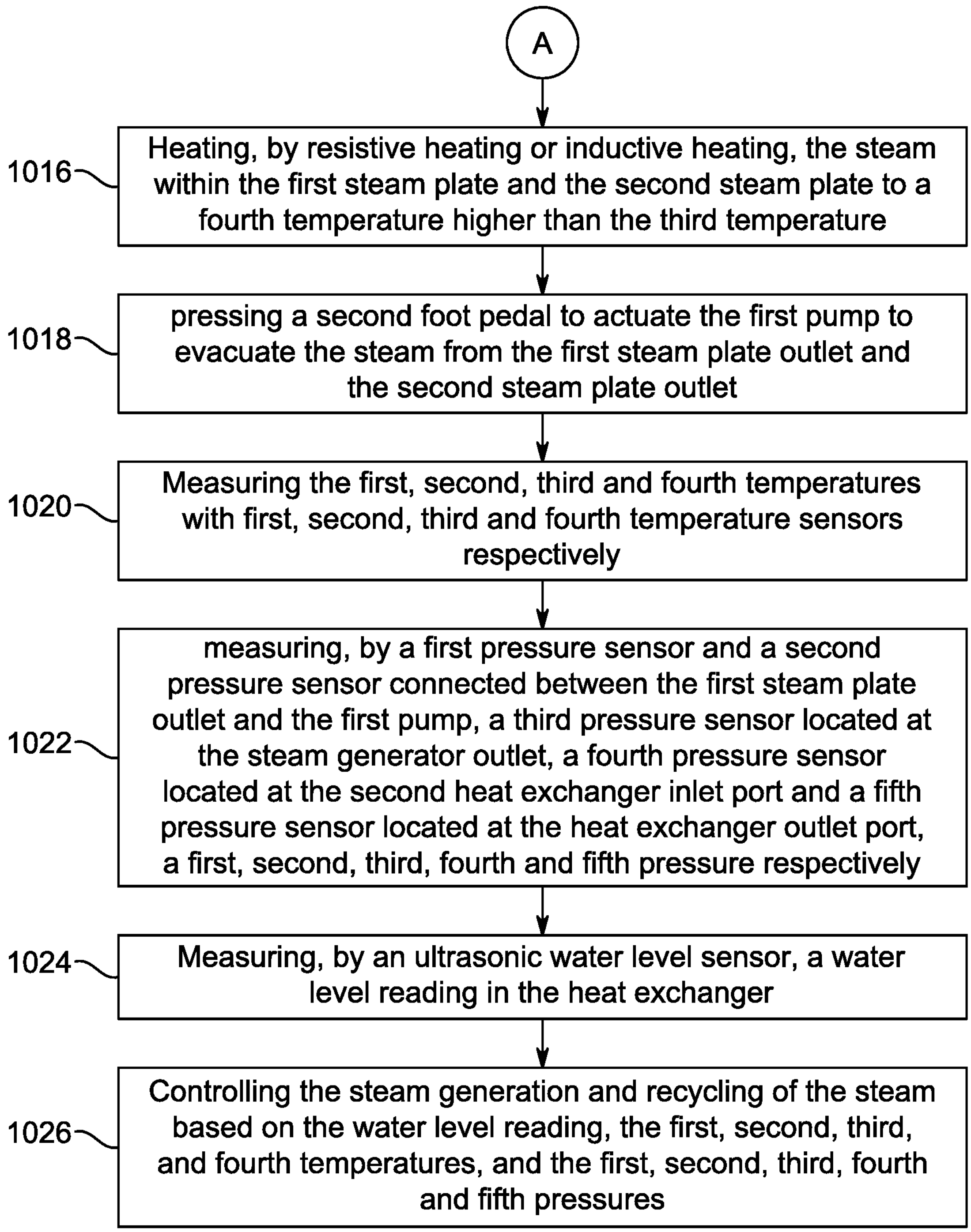
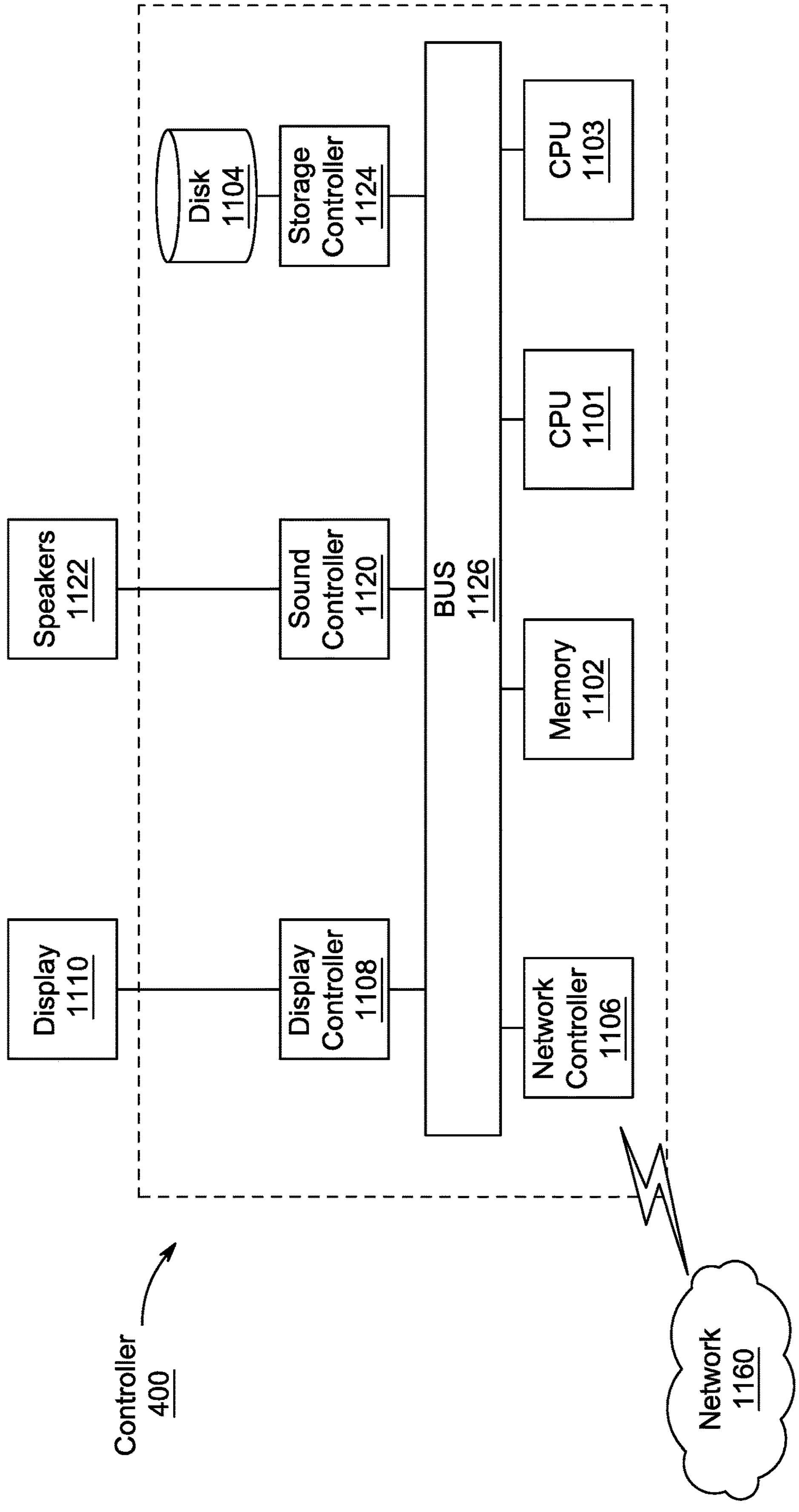

A
1016
Heating, by resistive heating or inductive heating, the steam within the first steam plate and the second steam plate to a fourth temperature higher than the third temperature
1018
pressing a second foot pedal to actuate the first pump to evacuate the steam from the first steam plate outlet and the second steam plate outlet
1020
Measuring the first, second, third and fourth temperatures with first, second, third and fourth temperature sensors respectively
1022
measuring, by a first pressure sensor and a second pressure sensor connected between the first steam plate outlet and the first pump, a third pressure sensor located at the steam generator outlet, a fourth pressure sensor located at the second heat exchanger inlet port and a fifth pressure sensor located at the heat exchanger outlet port, a first, second, third, fourth and fifth pressure respectively
1024
Measuring, by an ultrasonic water level sensor, a water level reading in the heat exchanger
1026
Controlling the steam generation and recycling of the steam based on the water level reading, the first, second, third, and fourth temperatures, and the first, second, third, fourth and fifth pressures

FIG. 10 (Cont'd)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BUS
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Display
1110
Display
Controller
1108
Network
Controller
1106
Controller
400
Network
1160

FIG. 11

SYSTEM AND METHODS FOR RECYCLING HEAT AND WATER IN A STEAM PRESS MACHINE

BACKGROUND

Technical Field

The present disclosure is directed to a steam press for ironing clothes and, more particularly, to a steam press system and methods of controlling steam generation and recycling steam therein.

Description of Related Art

The "background" description provided herein is for the purpose of generally presenting the context of the disclosure. Work of the presently named inventors, to the extent it is described in this background section, as well as aspects of the description which may not otherwise qualify as prior art at the time of filing, are neither expressly nor impliedly admitted as prior art against the present invention.

Conventional steam ironing machines include ironing boards defined by multiple holes to deliver steam. Steam may be generated by a steam generator that works in conjunction with a water pump for feeding a boiler of the steam generator, and a pipe network to supply water and generated steam. In an ironing operation, the steam is generated continuously in the boiler and delivered to the ironing boards where heat associated with the steam aids removal of wrinkles and provides a professional press appearance to garments. Steam ironing machines may also include a suction pump controlled by a foot pedal or the like, to regulate the vacuum pressure required to remove the steam from the garments and the boards. Thereafter, residual steam is rejected to a drain by the suction pump. Typically, the steam generators consume power in a range from 8 kW to 18 kW and the daily water consumption of a medium size commercial steam ironing machine ranges from 200 to 500 liters. Considering that a plurality of such commercial steam ironing machines operate in laundries and hotels worldwide, a large amount of electricity and water is consumed for steam generation during operation thereof.

CN206204654U describes a clothes steam ironing equipment with steam recycling function which includes a heat absorbing box with a radiating pipe connected to a waste steam inlet pipe that heats cold water, and reclaimed steam enters a heat sink pipe in the heat absorption box, surrounded by a heat sink. However, this publication does not describe ironing plates or a control system which uses the readings from pressure sensor(s) and/or temperature sensor(s) to render the steam and heat generation and reclamation process efficient.

CN109629214A describes a pressing/ironing box having a pressing plate which moves over the clothing on a pressing table; a hood over the pressing table collects waste heat that is used to preheat cold water entering a preheating box; a heating box that generates the steam; and a computer that controls the operation of switches, a water pump, an air pump, and valves. This publication fails to describe aspects of steam reclamation and the use of sensor(s) to render the process efficient.

CN207958816U describes an industrial iron capable of recycling steam, including a steam generator and a steam recovery device which supplies preheated water to the steam generator; a tube through the steam recovery device which exchanges heat with the recycled steam to warm the water.

CN211256302U describes a steam reclaiming iron in which the steam is recycled to preheat cold incoming water before the cold water is supplied to a heater. However, both CN207958816U and CN211256302U do not mention a computer control, or details of a heat exchanger, pressure valves, temperature sensors and controls.

As such, each of the aforementioned references suffers from one or more drawbacks hindering their adoption. Accordingly, it is one object of the present disclosure to provide system and methods of controlling steam generation and recycling the steam and heat contained within and used during pressing operations by using controlled procedures to render the steam and heat generation process and steam reclamation process efficient.

SUMMARY

In an exemplary embodiment, a steam press system is provided. The steam press system includes a first steam plate configured to receive steam at a first steam plate inlet and evacuate the steam through a first steam plate outlet. The steam press system also includes a second steam plate configured to receive steam at a second steam plate inlet and evacuate the steam through a second steam plate outlet. The steam press system further includes a first piping arrangement connected to the first steam plate outlet and the second steam plate outlet. The steam press system further includes a first pump connected to the first piping arrangement. The first pump is configured to draw steam from the first piping arrangement and expel the steam at a first pump outlet. The steam press system further includes a heat exchanger having a first heat exchanger inlet port connected to the first pump outlet. The steam press system further includes a second pump configured to pump fresh water at a first temperature from a freshwater source into a second heat exchanger inlet port. The heat exchanger is configured to condense the steam into the fresh water and heat the fresh water to a second temperature greater than the first temperature. The steam press system further includes a heat exchanger outlet port configured to expel the heated water. The steam press system further includes a third pump connected to the heat exchanger outlet port. The steam press system further includes a storage tank inlet connected to the third pump. The steam press system further includes a fourth pump connected to a storage tank outlet. The steam press system further includes a steam generator having a steam generator inlet connected to the fourth pump. The steam generator is configured to receive the heated water at the second temperature from the fourth pump. The steam generator is further configured to boil the heated water to generate steam at a third temperature. The steam generator is further configured to deliver the steam to the first steam plate inlet and the second steam plate inlet through a second piping arrangement.

In another exemplary embodiment, a method of recycling steam in a steam press is provided. The method includes receiving recycled steam, from a first pump connected to a first steam plate outlet and a second steam plate outlet, into a first heat exchanger inlet port. The method further includes pumping, with a second pump connected to a freshwater source, fresh water at a first temperature into a second heat exchanger inlet port. The method further includes expelling the recycled steam from a swirl generator connected to the first heat exchanger inlet port, thus imparting a swirling flow in the fresh water which mixes the recycled steam with the fresh water, generating mixed water having a second temperature higher than the first temperature, the second tem-

perature in a range of 90 degrees to 100 degrees. The method further includes pumping, with a third pump, the mixed water at the second temperature from a heat exchanger outlet port to a storage tank. The method further includes pumping, with a fourth pump, the mixed water at the second temperature to a steam generator. The method further includes heating, by providing power to a resistive heating element located in the steam generator, the mixed water at the second temperature to boiling, generating steam at third temperature. The method further includes delivering, by a controllable pressure valve, the steam at the third temperature to a first steam plate inlet and a second steam plate inlet.

In yet another exemplary embodiment, a method of controlling steam generation in a steam press is provided. The method includes pumping recycled steam from a first pump connected to a first steam plate outlet and a second steam plate outlet, into a first heat exchanger inlet port. The method further includes pumping, by a second pump, fresh water at a first temperature, into a second heat exchanger inlet port. The method further includes mixing the steam with fresh water at the first temperature in the heat exchanger with the recycled steam by a swirl generator, generating mixed water at a second temperature higher than the first temperature. The method further includes pumping, by a third pump, the mixed water through a check valve into a storage tank. The method further includes pumping, by a fourth pump, the mixed water from the storage tank into a steam generator. The method further includes heating, by providing power to a resistive heating element of a steam generator heating circuit located in the steam generator, the mixed water at the second temperature to boiling, thus generating steam at a third temperature. The method further includes pressing a first foot pedal to actuate a controllable pressure valve located at the steam generator outlet, to deliver the steam at the third temperature to a first steam plate inlet and a second steam plate inlet. The method further includes heating, by resistive heating or inductive heating, the steam within the first steam plate and the second steam plate to a fourth temperature higher than the third temperature. The method further includes pressing a second foot pedal to actuate the first pump to evacuate the steam from the first steam plate outlet and the second steam plate outlet. The method further includes measuring the first, second, third and fourth temperatures with first, second, third and fourth temperature sensors respectively. The method further includes measuring, by a first pressure sensor and a second pressure sensor connected between the first steam plate outlet and the first pump, a third pressure sensor located at the steam generator outlet, a fourth pressure sensor located at the second heat exchanger inlet port and a fifth pressure sensor located at the heat exchanger outlet port, a first, second, third, fourth and fifth pressure respectively. The method further includes measuring, by an ultrasonic water level sensor, a water level reading in the heat exchanger. The method further includes controlling the steam generation and recycling of the steam, by a controller connected to the first, second, third and fourth temperature sensors, the first, second, third, fourth and fifth pressure sensors, the ultrasonic water level sensor, the controllable pressure valve, and the steam generator heating circuit. The controller including a non-transitory computer readable medium having instructions stored therein that, when executed by one or more processors, cause the one or more processors to: monitor the water level reading in the heat exchanger; compare the water level to a water level threshold; monitor the first, second, third, and fourth temperatures; monitor the first, second, third, fourth and fifth pressures; compare the first, second, third, and fourth temperatures to a first set of temperature setpoint values; compare the first, second, third, fourth and fifth pressures to a second set of pressure setpoint values; and generate control signals to adjust the first pump, the second pump, the third pump, the fourth pump, the controllable pressure valve, and a power supplied to the steam generator heating circuit to cause the first, second, third, and fourth temperatures to match the first set of temperature setpoint values and the first, second, third, fourth and fifth pressures to match the second set of pressure setpoint values.

The foregoing general description of the illustrative embodiments and the following detailed description thereof are merely exemplary aspects of the teachings of this disclosure and are not restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of this disclosure and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. **1** is a diagrammatic perspective view of a steam press system, according to certain embodiments;

FIG. **2** is a schematic diagram of the steam press system of FIG. **1**, according to certain embodiments;

FIG. **3** is a schematic diagram of the steam press system of FIG. **1** depicting details of piping arrangements therein, according to certain embodiments;

FIG. **4** is a block diagram depicting connections between a controller and various components of the steam press system, according to certain embodiments;

FIG. **5** illustrates of a rotating arm based heat exchanger of the steam press system, according to one embodiment;

FIG. **6**A is a cross-sectional view of the rotating arm based heat exchanger of FIG. **5**, according to certain embodiments;

FIG. **6**B is a cross-sectional view of the rotating arm based heat exchanger of FIG. **5** with additional pipe arms, according to certain embodiments;

FIG. **6**C illustrates a ring based heat exchanger, according to certain embodiments.

FIG. **6**D illustrates ring support arms of the ring based heat exchanger of FIG. **6**C according to certain embodiments.

FIG. **6**E illustrates details of a side view of the ring based heat exchanger of FIG. **6**D, according to certain embodiments.

FIG. **6**F illustrates a ring based heat exchanger having two rings, according to certain embodiments.

FIG. **7** shows sectioned steam plates of the steam press system, according to certain embodiments;

FIG. **8**A is an exemplary cross-sectional view of steam plates of the steam press system of FIG. **7**, according to one embodiment;

FIG. **8**B is an exemplary cross-sectional view of steam plates of the steam press system of FIG. **7**, according to another embodiment;

FIG. **9** is a flowchart of a method of recycling steam in a steam press, according to certain embodiments;

FIG. **10** is a flowchart of a method of controlling steam generation in a steam press, according to certain embodiments; and

FIG. **11** is an illustration of details of computing hardware used in the controller of FIG. **4**, according to certain embodiments.

DETAILED DESCRIPTION

In the drawings, like reference numerals designate identical or corresponding parts throughout the several views. Further, as used herein, the words "a," "an" and the like generally carry a meaning of "one or more," unless stated otherwise.

Furthermore, the terms "approximately," "approximate," "about," and similar terms generally refer to ranges that include the identified value within a margin of 20%, 10%, or preferably 5%, and any values therebetween.

Aspects of the present disclosure are directed to a steam press system and methods of controlling steam generation and recycling steam therein. The steam press system includes a steam generator to deliver the steam to steam plates for ironing and steaming clothes, a suction pump to take out moisture and rejected steam from the steam plates, and a heat exchanger to exchange heat between the rejected steam and incoming fresh water to be passed to the steam generator. Water level control and pressure control are integrated into the steam generator. The steam press system allows recovery of heat from the rejected steam and uses the steam to heat the incoming fresh water before it enters the steam generator. As such, the steam generator requires minimal energy to convert the pre-heated water into steam. Further, the rejected steam and heat of the steam is captured and condensed in the heat exchanger, and subsequently recycled by the steam press system. Thus, the steam press system may reduce energy consumption and achieve a significant reduction in use of water.

Referring to FIG. **1**, a perspective view of a steam press system **100** is illustrated, according to an embodiment of the present disclosure. The steam press system **100** includes an outer case **102**. The outer case **102** is embodied as a cabinet having a predetermined volume to house various components of the steam press system **100**. Although in the illustrated example, the outer case **102** is shown as a cuboidal structure, it will be appreciated that, in other examples, the outer case **102** may have any other suitable shape (such as cylindrical). In some examples, the outer case **102** may be made of suitable materials to withstand high temperatures, such as, but not limited to, a high performance polymer including polytetrafluoroethylene (PTFE), austenitic stainless steels, and the like. In some examples, the outer case **102** may include an insulation layer to prevent loss of heat therefrom and to prevent accidental heat shock to a user operating the steam press system **100**.

The steam press system **100** includes a first steam plate **110** and a second steam plate **120**. The first steam plate **110** and the second steam plate **120** are coupled to the outer case **102**. Specifically, the first steam plate **110** and the second steam plate **120** are coupled to protrusions **104***a*, **104***b* of the outer case **102**. As shown, the protrusions **104***a*, **104***b* extend in a vertical direction from a top portion of the outer case **102**. The steam press system **100** also includes two struts, such as a first strut **106** and a second strut **108**, each extending from the first steam plate **110**. In some embodiments, the second steam plate **120** may be coupled to the outer case **102** with help of similar struts (not shown in FIG. **1**). Preferably, the second steam plate **120** is arranged vertically below the first steam plate **110** and the second steam plate **120** is stationary. In one embodiment, the first strut **106** and the second strut **108** may be pivotally coupled to the respective protrusions **104***a*, **104***b*, to allow angular movement of the first steam plate **110** with respect to the second steam plate **120**. In such arrangement, each of the first strut **106** and the second strut **108** may be coupled to the first steam plate **110** via a ball joint (not shown) to allow flexible movement on the first steam plate **110** by the user. The ball joint may allow the first steam plate **110** to be held parallel with respect to the second steam plate **120** when the first steam plate **110** is moved in an arcuate direction with respect to the second steam plate **120**. Further, each of the protrusions **104***a*, **104***b* may include a stopper (not shown) to restrict such angular movement of the first strut **106** and the second strut **108** beyond a predetermined angle. In some embodiments, each of the protrusions **104***a*, **104***b* may include a mechanism (not shown) to retain the first steam plate **110** at a desired angular position while the steam press system **100** is being used by the user. Such mechanism may add to the convenience of the user while the user replaces a garment to be ironed or changes a side of the garment to be ironed. Additionally, such mechanism may add to the comfort of a taller or a shorter user by allowing a higher or lower positioning of the upper steam plate.

In another embodiment, the first steam plate **110** may be connected to the protrusions **104***a*, **104***b* by, for example, a prismatic joint, such as a slider or the like, to allow vertical movement (downwards and upwards) of the first steam plate **110** in a direction towards or away with respect to the second steam plate **120**.

Each of the first steam plate **110** and the second steam plate **120** includes an inlet and an outlet to, respectively, receive and evacuate steam therefrom. In particular, the first steam plate **110** includes a first steam plate inlet **110***a* and a first steam plate outlet **110***b*, and the second steam plate **120** includes a second steam plate inlet **120***a* (as shown in FIG. **2**, not visible in FIG. **1**) and a second steam plate outlet **120***b* (generally labelled in FIG. **1** and more clearly shown in FIG. **2**). The first steam plate **110** is configured to receive steam at the first steam plate inlet **110***a* and vent the steam through the first steam plate outlet **110***b*. Similarly, the second steam plate **120** is configured to receive steam at the second steam plate inlet **120***a* and vent the steam through the second steam plate outlet **120***b*.

Further, the first steam plate **110** includes a first inner surface **112** (as shown in FIGS. **8**A and **8**B, not visible in FIG. **1**) and the second steam plate **120** includes a second inner surface **122**. The first inner surface **112** of the first steam plate **110** faces the second inner surface **122** of the second steam plate **120**. In an example, the first inner surface **112** and the second inner surface **122** are made from iron. In another example, the first inner surface **112** and the second inner surface **122** are made from one of anodized aluminum, titanium alloy, stainless steel, porcelain, satin aluminum, polished aluminum, ceramic, and titanium. These materials exhibit excellent heat conducting capability, aid in the even distribution of heat, prevent or eliminate static, provide a smooth surface, prevent the garment from sticking to the surface, and require minimum maintenance. In the steam press system **100**, each of the first inner surface **112** and the second inner surface **122** includes a pattern of holes (such as an array) distributed evenly. The first inner surface **112** of the first steam plate **110** define holes **114** (as shown in FIGS. **8**A and **8**B, not visible in FIG. **1**) and the second inner surface **122** of the second steam plate **120** define holes **124**. Each of the holes **114** in the first steam plate **110** and each of the holes **124** in the second steam plate **120** are configured to supply the steam, such that the garment placed between the first steam plate **110** and the second steam plate **120** may absorb the supplied steam from both sides, which in turn may aid in the ironing of the garment.

The steam press system **100** also includes a first foot pedal **130** and a second foot pedal located at a bottom portion of the outer case **102**, at a front side thereof. The first foot pedal **130** and the second foot pedal **132** are operated by the foot of the user. In some embodiments, the first foot pedal **130** and the second foot pedal **132** may be used to regulate the flow of steam. Further, the steam press system **100** may include a temperature control switch **134** and a pressure control switch **136** provided on the outer case **102**. As shown, the temperature control switch **134** and the pressure control switch **136** may be located on the front side of the outer case **102** so as to be accessible to the user. In an embodiment, the temperature control switch **134** and the pressure control switch **136** may be actuatable by a knee of the user. The temperature control switch **134** and the pressure control switch **136** may be configured to regulate the temperature and the pressure of the steam. In some embodiments, a display screen (not shown) may be provided on the outer case **102** to display values of the temperature and the pressure being set by the user via the temperature control switch **134** and the pressure control switch **136**, respectively. In some embodiments, the display screen may be a touch-screen configured to allow the user to select a type of material of the garment, such as cotton, silk, etc., and the value of the temperature and the pressure of the steam may be set automatically based on the type of the material.

FIG. **2** illustrates a schematic diagram of the steam press system **100** showing a block diagram of components housed within the outer case **102**. Referring to FIG. **1** and FIG. **2** in combination, the steam press system **100** includes a first piping arrangement **140** connected to the first steam plate outlet **110***b* and the second steam plate outlet **120***b*. The steam press system **100** also includes a second piping arrangement **142** connected to the first steam plate inlet **110***a* and the second steam plate inlet **120***a*. As illustrated in FIG. **2**, the steam press system **100** further includes a first pump **210** connected to the first piping arrangement **140**, a heat exchanger **220**, a second pump **230**, a third pump **240**, a storage tank **250**, a fourth pump **260** and a steam generator **270** connected to the second piping arrangement **142**. The first pump **210** has a first pump inlet **210***a* and a first pump outlet **210***b*; the heat exchanger **220** has a first heat exchanger inlet port **220***a*, a second heat exchanger inlet port **220***b* and a heat exchanger outlet port **220***c*; the second pump **230** has a second pump inlet **230***a* and a second pump outlet **230***b*; the third pump **240** has a third pump inlet **240***a* and a third pump outlet **240***b*; the storage tank **250** has a storage tank inlet **250***a* and a storage tank outlet **250***b*; the fourth pump **260** has a fourth pump inlet **260***a* and a fourth pump outlet **260***b*; and the steam generator **270** has a steam generator inlet **270***a* and a steam generator outlet **270***b*. The first pump inlet **210***a* is connected to the first steam plate outlet **110***b* and the second steam plate outlet **120***b* via the first piping arrangement **140**, and the first pump outlet **210***b* is connected to the first heat exchanger inlet port **220***a*. Further, the second pump inlet **230***a* is connected to a freshwater source, such as a reservoir (not shown) or cold water pipe (not shown), and the second pump outlet **230***b* is connected to the second heat exchanger inlet port **220***b*. Further, the third pump inlet **240***a* is connected to the heat exchanger outlet port **220***c* and the third pump outlet **240***b* is connected to the storage tank inlet **250***a*. Further, the fourth pump inlet **260***a* is connected to the storage tank outlet **250***b* and the fourth pump outlet **260***b* is connected to the steam generator inlet **270***a*. Additionally, the steam generator outlet **270***b* is connected to the first steam plate inlet **110***a* and the second steam plate inlet **120***a* via the second piping arrangement **142**.

The first pump **210**, the heat exchanger **220**, the second pump **230**, the third pump **240**, the storage tank **250**, the fourth pump **260** and the steam generator **270** are enclosed within the outer case **102**. However, in other examples, one or more of these components may be located outside of the outer case **102** and suitably connected to remaining component(s) housed inside the outer case **102**. It may also be understood (and as may be seen from FIG. **1**) that the first piping arrangement **140** and the second piping arrangement **142** may be located partially outside the outer case **102** to be connected to the steam plates **110**, **120**, and may be located partially inside the outer case **102** to be connected to the first pump **210** and the steam generator **270**, respectively. The first piping arrangement **140** and the second piping arrangement **142** may extend from openings defined in the outer case **102**, or in the protrusions **104***a*, **104***b* of the outer case **102**. In the illustrated embodiment, the openings are defined on lateral sides of the protrusions **104***a*, **104***b*. However, alternatively, the openings may be formed at front sides of the protrusions **104***a*, **104***b* of the outer case **102**, facing the first steam plate **110** and the second steam plate **120**. Each of the first piping arrangement **140** and the second piping arrangement **142** is configured to allow flow of steam therethrough and hence may be at high temperatures. In some embodiments, portions of the first piping arrangement **140** and the second piping arrangement **142** exposed to the outside of the outer case **102** may be insulated (i.e., provided with an insulating layer) to prevent burns due to accidental touching by the user while operating the steam press system **100**.

In some embodiments, the various components of the steam press system **100** may work in conjunction with one another to generate and recycle the steam therein. In the steam press system **100**, the first pump **210** is configured to draw the steam from the first piping arrangement **140**. The first pump **210** is further configured to receive the rejected steam at the first pump inlet **210***a*, increase pressure of the steam, and expel the steam via the first pump outlet **210***b*, so that the pressurized steam is directed into the heat exchanger **220** via the first heat exchanger inlet port **220***a*. The second pump **230** is configured to pump fresh water at a first temperature from the freshwater source into the heat exchanger **220** via the second heat exchanger inlet port **220***b*. The first temperature may be in a range of about 5 degrees Celsius to about 35 degrees Celsius. The heat exchanger **220** is configured to condense the received pressurized steam by heating the fresh water to a second temperature greater than the first temperature. In an example, the second temperature is in a range of about 85 degrees Celsius to about 100 degrees Celsius.

The steam press system **100** may include a water level sensor **222** deposed within the heat exchanger **220**. In a non-limiting example, the water level sensor **222** is an ultrasonic water level sensor, available from, for example, Water Level Control, Arizona, U.S. The water level sensor **222** is configured to detect a level of the water inside the heat exchanger **220** and generate a water level reading. Further, the heat exchanger outlet port **220***c* is configured to expel the heated water. In an example, the heated water is expelled based on the water level reading, i.e., when the water level is above a predefined water level threshold. Thereafter, the third pump **240** is configured to transfer the heated water from the heat exchanger outlet port **220***c* to the storage tank inlet **250***a*, to be stored in the storage tank **250**. The storage tank **250** is configured to store the heated water at the second temperature. For this purpose, the storage tank **250** may be provided with an insulation layer. In some examples, the steam press system **100** also includes a check valve **252** located between the third pump **240** and the storage tank inlet **250***a*. The check valve **252** is configured to prevent backflow of the heated water from the storage tank **250**. The fourth pump **260** is configured to pump the stored heated water from the storage tank **250** via the storage tank outlet **250***b* to the steam generator **270** via the steam generator inlet **270***a*.

The steam generator **270** is configured to receive the heated water at the second temperature from the fourth pump **260** and boil the heated water to generate steam at a third temperature. In some embodiments, the steam press system **100** may include a steam generator heating circuit **272** located within the steam generator **270**. The steam generator heating circuit **272** is configured to control generation of heat within the steam generator **270**, based on, for example, an amount of heated water to be converted to the steam at the third temperature. In an example, the steam generator heating circuit **272** includes at least one steam generator heating element **274**, a power switch **275**, and a temperature control circuit **276**. The steam generator heating element **274** may be configured to generate the heat required to boil the water. In an example, the steam generator heating element **274** is a resistive heating element as known in the art ("the steam generator heating element" and "resistive heating element" are interchangeably used hereinafter). The power switch **275** may be configured to control switching ON and OFF the steam generator **270** and may be accessible from the outside of the housing by a connected button or switch. Further, the temperature control circuit **276** may be configured to control the steam generator heating element **274** to regulate steam generation with its temperature up to the third temperature. In an example, the third temperature may be in a range of 130 degrees Celsius to 180 degrees Celsius. The steam generator **270** is further configured to deliver the steam to the first steam plate inlet **110***a* and the second steam plate inlet **120***a* through the second piping arrangement **142**. In some embodiments, the steam press system **100** may include a controllable pressure valve **278** connected between the steam generator outlet **270***b*, and the first steam plate inlet **110***a* and the second steam plate inlet **120***a* to ensure a regulated pressure of the steam is supplied to the first steam plate **110** and the second steam plate **120**. The regulated pressure may be in the range of five bars to six bars. Further, the first steam plate **110** and the second steam plate **120** may be configured to further heat (superheat) the received steam from the third temperature to a fourth temperature greater than the third temperature. In an example, the fourth temperature may be in a range of 180 degrees Celsius to 190 degrees Celsius.

In some embodiments, the first foot pedal **130** is configured to release steam from the steam generator **270**. That is, the first foot pedal **130** is configured to control the flow of steam from the steam generator **270** into the first steam plate inlet **110***a* and the second steam plate inlet **120***a*. For this purpose, as shown in FIG. **2**, the first foot pedal **130** may be mechanically or electronically connected to the steam generator **270**, for example, to control opening and closing of the steam generator outlet **270***b* or a valve connected to the steam generator outlet **270***b*. Further, as discussed, the first pump **210** is configured to draw the steam from the first steam plate outlet **110***b* and the second steam plate outlet **120***b*, via the first piping arrangement **140**, and expel the steam at the first pump outlet **210***b*. In some embodiments, the second foot pedal **132** is configured to operate the first pump **210** to evacuate the steam from the first steam plate outlet **110***b* and the second steam plate outlet **120***b*. In particular, the second foot pedal **132** is configured to open a valve to eject the steam through the holes **114** and **124** in the first inner surface **112** and the second inner surface **122**, respectively, and thereafter the first pump **210** is operated to evacuate the steam from the first steam plate outlet **110***b* and the second steam plate outlet **120***b*. For this purpose, as shown in FIG. **2**, the second foot pedal **132** may be mechanically or electronically connected to the first pump **210** to regulate suction power of the first pump **210**, and/or to control opening and closing of the first pump inlet **210***a* and the first pump outlet **210***b*.

Referring to FIG. **3**, a schematic diagram of the steam press system **100** is illustrated to depict details of the first piping arrangement **140** and the second piping arrangement **142**. As shown, the first piping arrangement **140** includes a first hose coupling **302**. The first hose coupling **302** is configured with a flexible joint, in which the flexible joint is configured to bend at an angle in the range of zero degrees to 90 degrees. Further, the first piping arrangement **140** also includes a first flexible hose **304** connected between the first steam plate outlet **110***b* and the first hose coupling **302**. The flexible connection established by the first hose coupling **302** and the first flexible hose **304** may allow movement of the first steam plate **110** with respect to the second steam plate **120** in an arcuate manner or vertical manner as described with respect to FIG. **1**. Further, the first piping arrangement **140** includes a second hose coupling **306** configured with a 90 degree bend. The first piping arrangement **140** also includes a second flexible hose **308** connected between the second steam plate outlet **120***b* and the second hose coupling **306**. Such connection as provided by the second hose coupling **306** and the second flexible hose **308** allows a flexible connection of the first hose coupling **302** and the first flexible hose **304** to the steam plates, to enable relative movement between the first steam plate **110** and the second steam plate **120** in the steam press system **100**.

The first piping arrangement **140** further includes a third hose coupling **310** having a T shape, with a first T joint **310***a*, a second T joint **310***b* and a main joint **310***c*. A first rigid pipe **312** is connected between the first T joint **310***a* of the third hose coupling **310** and the first hose coupling **302**. A second rigid pipe **314** is connected between the second T joint **310***b* of the third hose coupling **310** and the second hose coupling **306**. Further, a third rigid pipe **316** is connected to the main joint **310***c* of the third hose coupling **310**. The first piping arrangement **140** further includes a fourth hose coupling **318** configured with a 90 degree bend. The third rigid pipe **316** is connected to the fourth hose coupling **318**. Also, a fourth rigid pipe **320** is connected to the fourth hose coupling **318**. The first piping arrangement **140** further includes a fifth hose coupling **322** configured with a 90 degree bend, and the fourth rigid pipe **320** is connected to the fifth hose coupling **322**. A fifth rigid pipe **324** is also connected to the fifth hose coupling **322**. The first piping arrangement **140** further includes a sixth hose coupling **326** having a T shape, with a first T joint **326***a*, a second T joint **326***b* and a main joint **326***c*. The first T joint **326***a* of the sixth hose coupling **326** is connected to the fifth rigid pipe **324**. A sixth rigid pipe **328** is connected to the second T joint **326***b* of the sixth hose coupling **326**. The first piping arrangement **140** further includes a seventh hose coupling **330** having a T shape with a first T joint **330***a*, a second T joint **330***b* and a main joint **330***c*. The first T joint **330***a* of the seventh hose coupling **330** is connected to the sixth rigid pipe **328**. A seventh rigid pipe **332** is connected to the second T joint **330***b* of the seventh hose coupling **330**. The first piping arrangement **140** further includes an eighth hose coupling **334** having a 90 degree bend. The eighth hose coupling **334** is connected to the seventh rigid pipe **332**. Further, an eighth rigid pipe **336** is connected to the main joint **326***c* of the sixth hose coupling **326**. The first piping arrangement **140** further includes a ninth hose coupling **338** having a 90 degree bend. A ninth rigid pipe **340** is connected to the ninth hose coupling **338**. The first piping arrangement **140** further includes a tenth hose coupling **342** having a 90 degree bend. The tenth hose coupling **342** is connected to the ninth rigid pipe **340**. Further, a tenth rigid pipe **344** is connected to the tenth hose coupling **342** and the main joint **330***c* of the seventh hose coupling **330**. Further, a third flexible hose **346** is connected between the eighth hose coupling **334** and the first pump **210**. The third flexible hose **346** allows for some movement of the first pump **210** with respect to the first piping arrangement **140**, in the steam press system **100**.

As discussed with reference to FIG. **2**, the first pump **210** draws the steam from the first piping arrangement **140** and expels the steam at the first pump outlet **210***b*. Referring to FIG. **2** and FIG. **3** in combination, the first piping arrangement **140** may include a first pressure sensor **280** coupled to the sixth rigid pipe **328**. The first piping arrangement **140** may also include a second pressure sensor **282** coupled to the seventh rigid pipe **332**. That is, the first pressure sensor **280** and the second pressure sensor **282** are connected between the first steam plate outlet **110***b* and the first pump **210**. The first piping arrangement **140** may further include a first temperature sensor **284** coupled to the ninth rigid pipe **340**. That is, the first temperature sensor **284** is connected in a bypass line between the first steam plate outlet **110***b* and the first pump **210**. In some embodiments, the first pressure sensor **280** and the second pressure sensor **282** may be configured to measure and provide readings for first pressure and second pressure of the steam passing through the sixth rigid pipe **328** and the seventh rigid pipe **332**, respectively. Further, the first temperature sensor **284** may be configured to measure and provide readings for the first temperature of the steam passing through the ninth rigid pipe **340**. Together, the first pressure sensor **280**, the second pressure sensor **282** and the first temperature sensor **284** may determine temperature and pressure readings of the rejected steam, as received from the first piping arrangement **140**. The first pressure and the second pressure should be in the range of five bars to six bars.

The second piping arrangement **142** includes an eleventh hose coupling **362**. The eleventh hose coupling **362** is configured with a flexible joint, in which the flexible joint is configured to bend at an angle in the range of zero degrees to 90 degrees. Further, the second piping arrangement **142** includes a fourth flexible hose **364** connected between the first steam plate inlet **110***a* and the eleventh hose coupling **362**. The flexible connection established by the eleventh hose coupling **362** and the fourth flexible hose **364** allows movement of the first steam plate **110** with respect to the second steam plate **120** in the upwards and downwards directions. Further, the second piping arrangement **142** includes a twelfth hose coupling **366** configured with a 90 degree bend. The second piping arrangement **142** also includes a fifth flexible hose **368** connected between the second steam plate inlet **120***a* and the twelfth hose coupling **366**. Such connection as provided by the twelfth hose coupling **366** and the fifth flexible hose **368** allows to accommodate for flexible connection provided by the eleventh hose coupling **362** and the fourth flexible hose **364**, to enable relative movement between the first steam plate **110** and the second steam plate **120** in the steam press system **100**.

The second piping arrangement **142** further includes a thirteenth hose coupling **370** having a T shape, with a first T joint **370***a*, a second T joint **370***b* and a main joint **370***c*. An eleventh rigid pipe **372** is connected between the first T joint **370***a* of the thirteenth hose coupling **370** and the eleventh hose coupling **362**. A twelfth rigid pipe **374** is connected between the second T joint **370***b* of the thirteenth hose coupling **370** and the twelfth hose coupling **366**. Further, a thirteenth rigid pipe **376** is connected to the main joint **370***c* of the thirteenth hose coupling **370**. The second piping arrangement **142** further includes a fourteenth hose coupling **378** configured with a 90 degree bend. The thirteenth rigid pipe **376** is connected to the fourteenth hose coupling **378**. Also, a sixth flexible hose **380** is connected between the fourteenth hose coupling **378** and the steam generator **270**. The sixth flexible hose **380** allows for some movement of the steam generator **270** with respect to the second piping arrangement **142**, in the steam press system **100**.

As discussed with reference to FIG. **2**, the steam generator **270** delivers the steam to the first steam plate inlet **110***a* and the second steam plate inlet **120***a* through the second piping arrangement **142**. Referring to FIG. **2** and FIG. **3** in combination, the second piping arrangement **142** may include a third pressure sensor **286** coupled to the thirteenth rigid pipe **376**. In an embodiment, the third pressure sensor **286** is located at the steam generator outlet **270***b*. The second piping arrangement **142** may also include a third temperature sensor **288** connected to the thirteenth rigid pipe **376**. That is, the third temperature sensor **288** is located at the steam generator outlet **270***b*. In some embodiments, the third pressure sensor **286** may be configured to measure and provide readings for third pressure of the steam passing through the thirteenth rigid pipe **376**. Further, the third temperature sensor **288** may be configured to measure and provide readings for the third temperature of the steam passing through the thirteenth rigid pipe **376**. Together, the third pressure sensor **286** and the third temperature sensor **288** may determine temperature and pressure readings of the steam, to be supplied via the second piping arrangement **142**. The third pressure may be within the range of five bars to six bars.

Referring back to FIG. **2**, the steam press system **100** further includes a fourth pressure sensor **290** located at the second heat exchanger inlet port **220***b*. The fourth pressure sensor **290** may be configured to measure and provide readings for fourth pressure of fresh water being supplied to the heat exchanger **220**. The steam press system **100** further includes a fifth pressure sensor **292** located at the heat exchanger outlet port **220***c*. The fifth pressure sensor **292** may be configured to measure and provide readings for fifth pressure of the heated water being provided by the heat exchanger **220**. The fifth pressure may be within the range of five bars to six bars. The steam press system **100** further includes a second temperature sensor **294** located at the heat exchanger outlet port **220***c*. The second temperature sensor **294** may be configured to measure and provide readings for the second temperature of the heated water being provided by the heat exchanger **220**. The steam press system **100** further includes a fourth temperature sensor **296** located in at least one of the first steam plate **110** and the second steam plate **120**. In an example, the fourth temperature sensor **296** may include two temperature sensors located in each of the first steam plate **110** and the second steam plate **120**. The fourth temperature sensor **296** may be configured to measure and provide readings for the fourth temperature of the steam in the first steam plate **110** and the second steam plate **120**.

In some embodiments, the steam press system **100** further includes a controller **400** configured to control generation and recycling of the steam. FIG. **4** illustrates an exemplary block diagram showing connections between the controller **400** and various components of the steam press system **100**. As shown, the controller **400** is connected to:

(a) the first temperature sensor **284**, the second temperature sensor **294**, the third temperature sensor **288**, the fourth temperature sensor **296** to receive respective readings for the first, second, third, and fourth temperatures;

(b) the first pressure sensor **280**, the second pressure sensor **282**, the third pressure sensor **286**, the fourth pressure sensor **290**, the fifth pressure sensor **292** to receive respective readings of the first, second, third, fourth and fifth pressures, wherein the first, second, third, fourth and fifth pressures are within the range of five bars to six bars;

(c) the controllable pressure valve **278** to regulate flow of the steam by controlling the pressure of the steam (i.e., the third pressure) being supplied to the first steam plate **110** and the second steam plate **120**; and

(d) the steam generator heating circuit **272** to control steam generation.

In the steam generator heating circuit **272**, the controller **400** is connected to: (a) the steam generator heating element **274** to regulate supply of power thereto thereby controlling the temperature and pressure within the steam generator **270**, and (b) the power switch **275** and the temperature control circuit **276** to control heating of the water in the steam generator **270** and thus generation of the steam. The controller **400** may further be connected to the water level sensor **222** to receive the corresponding water level reading therefrom. The controller **400** is configured to adjust a power supplied to the first pump **210** based on the water level reading to supply a sufficient amount of the rejected heat to bring the temperature of water in the heat exchanger **220** to the required second temperature. In some embodiments, the controller **400** may also be provided with a first set of temperature setpoint values which may define standard operational values for the first, second, third, and fourth temperatures, and a second set of pressure setpoint values which may define standard operational values for the first, second, third, fourth and fifth pressures. The said first set of temperature setpoint values and the second set of pressure setpoint values may be stored in a memory (such as a memory **1102** in FIG. **11**) associated with the controller **400**. Further, the controller **400** is connected to the temperature control switch **134** and the pressure control switch **136**. The temperature control switch **134** and the pressure control switch **136** may be operated to provide instructions to change the first set of temperature setpoint values and the second set of pressure setpoint values, respectively, stored in the controller **400**, for example, for particular ironing operation based on the requirement.

In some embodiments, the controller **400** includes a non-transitory computer readable medium having instructions stored therein that, when executed by one or more processors, cause the one or more processors to perform corresponding functions. In some embodiments, the controller **400** may be implemented in hardware, firmware or software, or some combination of at least two of the same. It should be noted that the functionality associated with the controller **400** may be centralized or distributed, whether locally or remotely. The controller **400** may be a multi-core processor, a single core processor, or a combination of one or more multi-core processors and one or more single core processors. For example, the one or more processors may be embodied as one or more of various processing devices, such as a coprocessor, a microprocessor, a digital signal processor (DSP), a processing circuitry with or without an accompanying DSP, or various other processing devices including integrated circuits such as, for example, an application specific integrated circuit (ASIC), a field programmable gate array (FPGA), a microcontroller unit (MCU), a hardware accelerator, a special-purpose computer chip, or the like. Further, the memory associated with the controller **400** may include one or more non-transitory computer-readable storage media that can be read or accessed by other components in the device. The memory may be any computer-readable storage media, including volatile and/or non-volatile storage components, such as optical, magnetic, organic, or other memory or disc storage, which can be integrated in whole or in part with the device. In some examples, the memory may be implemented using a single physical device (e.g., optical, magnetic, organic, or other memory or disc storage unit), while in other embodiments, the memory may be implemented using two or more physical devices without any limitations.

In some embodiments, the controller **400** is configured to monitor the first, second, third, and fourth temperatures. The controller **400** is further configured to monitor the first, second, third, fourth and fifth pressures. The controller **400** is also configured to compare the first, second, third, and fourth temperatures to the first set of temperature setpoint values. The controller **400** is further configured to compare the first, second, third, fourth and fifth pressures to the second set of pressure setpoint values. As such, the controller **400** may be configured to generate control signals to adjust the first pump **210**, the second pump **230**, the third pump **240**, the fourth pump **260**, the controllable pressure valve **278**, and a power supplied to the steam generator heating circuit **272** to the first set of temperature setpoint values and the second set of pressure setpoint values. In particular, the controller **400** is configured to generate control signals to adjust the first pump **210**, the second pump **230**, the third pump **240**, the fourth pump **260**, the controllable pressure valve **278**, and the power supplied to the steam generator heating circuit **272** to cause the first, second, third, and fourth temperatures to match the first set of temperature setpoint values and the first, second, third, fourth and fifth pressures to match the second set of pressure setpoint values. That is, the controller **400** may control the components to regulate the first, second, third, and fourth temperatures, and the first, second, third, fourth and fifth pressures based on the corresponding setpoint values as preset by the user. For instance, if the user wishes to use steam with high temperature and high pressure to iron heavy clothes, then the user may use the temperature control switch **134** to increase the setpoint value for the third temperature (i.e., the temperature at which the steam is supplied to the first steam plate **110** and the second steam plate **120**) and the pressure control switch **136** to increase the setpoint value for the third pressure (i.e., the pressure at which the steam is supplied to the first steam plate **110** and the second steam plate **120**). It may be appreciated that the setpoint values for other temperatures and pressures may automatically be adjusted based on adjustment of, for example, the third temperature and/or the third pressure based on operating parameters of the steam press system **100**. As would be contemplated by a person skilled in the art, the controller **400** may utilize predefined or preprogrammed value maps for this purpose, not described herein for brevity of the present disclosure.

Referring to FIG. **5**, a perspective view of the heat exchanger **220** is illustrated. Further referring to FIG. **6**A, a cross-sectional view of the heat exchanger **220** of FIG. **5** is illustrated. As shown in FIG. **5** and FIG. **6**A, the heat exchanger **220** includes a housing **502** embodied as a cylindrical insulated structure. That is, the housing **502** may include an insulation layer (not shown) thereon. The insulation layer may prevent loss of heat from the interior of the housing **502** where the rejected steam at high temperature is received to mix with fresh water to generate heated water. As seen in FIG. **5**, the housing **502** provides the first heat exchanger inlet port **220***a*, the second heat exchanger inlet port **220***b* and the heat exchanger outlet port **220***c*.

In some embodiments, the heat exchanger **220** is a direct contact heat exchanger to achieve rapid condensation and maximum heat transfer. The heat exchanger **220** includes a plurality of supports **504**, ends of which are attached to interior of the housing **502**. Each support **504** has a circular opening **506** (see FIG. **6**A) at a central location. In an example, each circular opening **506** includes a rotatable bearing (not shown). Further, as shown, the heat exchanger **220** includes a swirl generator **510** inserted through the first heat exchanger inlet port **220***a* and through the rotatable bearings. In the heat exchanger **220**, the swirl generator **510** is connected to the first pump outlet **210***b*. The swirl generator **510** is in the form of a pipe and is configured to extend coaxially with a central axis of the cylindrical insulated housing **502**. Furthermore, as shown, the heat exchanger **220** includes a plurality of pipe arms **512** located on the swirl generator **510**. In the example illustration of FIGS. **5** and **6**A, four pipe arms **512** are shown, arranged in two pairs disposed in two planes towards bottom of the housing **502**. Each pipe arm **512** ends in a 90 degree bend (as represented by reference numeral **514**). Although the bends **514** are disposed at 90 degrees and in same plane with respect to the corresponding pipe arm **512**, in other embodiments, the bends **514** may be disposed at angles other than 90 degrees and in a different plane with respect to the corresponding pipe arm **512**. In the heat exchanger **220**, each pipe arm **512** is configured receive steam from the swirl generator **510** and expel steam into the freshwater present in the housing **502** through the respective bend **514**. The bends **514** act as nozzles to expel steam into the fresh water at high pressure. This expelling of the steam from oppositely directed bends **514** may generate opposing force, which rotates each pipe arm **512** around the central axis (due to support of the swirl generator **510** by the rotatable bearings), such that a swirling flow is generated in the freshwater to cause proper mixing of the steam into the fresh water and thus faster heating of water in the heat exchanger **220**. In some embodiments, a size (area) of opening of the bends (nozzles) **514** may be varied to regulate pressure at which the steam is expelled into the fresh water, and thereby control swirling flow generated in the heat exchanger **220**. Referring to FIG. **6**B, a cross-sectional view of the heat exchanger **220** is illustrated according to another embodiment. The swirl generator **510** may include additional pipe arms **602**, specifically two additional pipe arms **602** with corresponding bends **604**. In an embodiment, the pipe arms **602** and the pipe arms **512** may be located equidistant from an adjacent pipe arm along the swirl generator **510**. Such additional pipe arms **602** may help with uniform expelling of the steam inside the housing **502** of the heat exchanger **220** and may further increase degree of swirl in the freshwater, thereby resulting in even mixing of the steam with the freshwater. Thus, faster heating of water in the heat exchanger **220** may be achieved as compared to the embodiment illustrated in FIG. **6**A.

FIG. **6**C illustrates an alternative embodiment of the heat exchanger **220**. In FIG. **6**C, a ring **618** is employed to mix the recycled steam **622** generated by the steam press of the previous embodiments. A manifold having a first pipe branch **614** and a second pipe branch **610** splits the recycled steam **622** into two streams. The steam from first pipe branch **614** enters the housing through a first steam port **616** and the steam from the second pipe branch **610** enters the housing through a second steam port **612**. Each steam port includes a seal to prevent water loss from the housing **502**. The first pipe branch **614** and the second pipe branch **610** are fluidly connected to each other and to a ring **618**, which has steam holes **620**. Additionally, a steam hole **620** (see FIG. **6**D) is located in the pipe at the center of the ring **618**. A water pipe **606** having an end in the water, W, inside the housing, draws the heated water (through action of a pump, not shown) out of the housing, where it is delivered to the steam generator **270**. Alternatively, the heated water may be delivered to the storage tank **250**. The pump may be essentially the same as the pump **240** or the pump **260** shown in FIG. **2**. The heated water pipe **606** exits the housing **502** through a sealed exit port **608**. The heat exchanger **220** is supplied with fresh water **628**, which is pumped by fresh water pump **626** through fresh water pipe **624** into the bottom of the housing **220**. In operation, steam from the steam manifold is propelled into the water at the bottom of the housing through the steam holes. The pressure of the steam entering the water in the housing **502** may be within the range of five bars to six bars, and the temperature of the fresh water may initially be in the range of about 5 degrees Celsius to about 35 degrees Celsius. The heat from the steam heats the fresh water to a second temperature in a range of about 85 degrees Celsius to about 100 degrees Celsius.

FIG. **6**D illustrates a manner in which the ring **618** may be supported within the housing **502**. An outer ring **638** may be connected to the inner wall of the housing by mounts **632** and held in place by collars **634**. Spokes **630** radiating from the outer ring **638** are connected to the ring **618** by clamps (not shown). The steam holes **620** are shown in the ring **618** and in the center of the steam manifold. The collars **634** may be rubber or rubberized metal to prevent vibration noise. The mounts **632** may hold the ring **618** at a height in the range of 2 cm to 10 cm above the bottom of the housing **520**.

FIG. **6**E shows a side view of the heat exchanger of FIG. **6**C, in which a fresh water inlet port **668** at the bottom **656** of housing **502** is shown more clearly. The steam holes **620** in the ring and in the center of the steam pipe are shown. The sealed exit port **608** is shown at the top 650 of the heat exchanger.

FIG. **6**F illustrates another embodiment of the heat exchanger **220** having two steam rings. The embodiment of FIG. **6**F is essentially the same as the embodiment of FIG. **6**C, but with the addition of a second steam ring. A top cross-section is shown in which ring **618** is an inner ring and ring **664** is an outer ring. Ring **618** has steam holes **620** and ring **664** has steam holes **666**. The manifold labelled as first pipe branch **614** and second pipe branch **610** also has a steam hole **620**. The manifold is fluidly connected to the ring **618** and the ring **664**. The ring **618** and the ring **664** are concentric and at the same height from the bottom of the housing, which height may be in the range of 2 cm to 10 cm above the bottom of the housing **520**.

In FIG. **6**C-FIG. **6**F, the steam holes **620** and **666** may be 2 mm to 6 mm in diameter. In a particular embodiment of the ring **618** of FIG. **6**C, the steam holes **620** may be 4 mm in diameter. In a particular embodiment of the ring **618** of FIG. **6**C, the steam holes **620** may be 2 mm in diameter. In another particular embodiment of FIG. **6**F, the ring **618** may have steam holes of 2 mm in diameter and the ring **624** may have steam holes **666** may have a diameter of 4 mm. In another embodiment of FIG. **6**F, the ring **618** may have steam holes of 4 mm in diameter and the ring **624** may have steam holes **666** may have a diameter of 2 mm. In another embodiment of FIG. **6**F, the ring **618** may have steam holes of 4 mm in diameter and the ring **624** may have steam holes **666** may have a diameter of 4 mm. In another embodiment of FIG. **6**F, the ring **618** may have steam holes of 6 mm in diameter and the ring **624** may have steam holes **666** may have a diameter of 4 mm. In another embodiment of FIG. **6**F, the ring **618** may have steam holes of 4 mm in diameter and the ring **624** may have steam holes **666** may have a diameter of 6 mm. In another embodiment of FIG. **6**F, the diameters of the steam holes **620** and **666** may be the same. In another embodiment of FIG. **6**F, the diameters of the steam holes **620** and **666** may be different, in the range of 2 mm to 6 mm.

In an embodiment, the height of the heat exchanger **200** is 100 cm. However, the height of the heat exchanger **220** is not limiting and may be greater or less than 100 cm, depending on the needs of specific applications.

Any of the embodiments shown in FIG. **6**C, and FIG. **6**E-FIG. **6**F may include the support structure shown in FIG. **6**D.

FIG. **7** illustrates sectioned steam plates of the steam press system of the steam press system **100**. FIGS. **8**A-**8**B illustrate cross-sectional views of steam plates **110**, **120** of the steam press system **100** according to two different embodiments. Together referring to FIG. **7**, FIG. **8**A and FIG. **8**B, as illustrated, the first steam plate **110** includes a first steam plate housing **710** having the first inner surface **112**, a top cover **712**, and a first middle region **714**. The first middle region **714** is defined between the first inner surface **112** and the top cover **712**. The top cover **712** includes extensions **716** around its circumference which protrude past the first inner surface **112**. Further, the second steam plate **120** includes a second steam plate housing **720** having the second inner surface **122**, a bottom cover **722** and a second middle region **724**. The second middle region **724** is defined between the second inner surface **122** and the bottom cover **722**. Also, the second inner surface **122** has a groove **726** around its circumference. The groove **726** is configured to receive the extensions **716** of the first steam plate housing **710** when the first steam plate **110** is pressed against the second steam plate **120**, thereby achieving a leak-proof engagement of the first steam plate **110** with the second steam plate **120** in the steam press system **100**. The outer surfaces of the steam plates may include insulation to prevent burns and may have handles or other hardware to allow the user to raise and lower the upper steam plate without being burned.

In one embodiment, as illustrated in FIG. **8**A, the steam press system **100** may include an electromagnetic coil **810** located within the first middle region **714**. Also, an alternating current circuit **812** (schematically shown) is coupled to the electromagnetic coil **810**, such that the electromagnetic coil **810** generates an alternating magnetic induction field when the alternating current is applied by the alternating current circuit **812**. Further, the steam press system **100** may include a permanent magnet **814** located within the second middle region **724**. Eddy currents are generated in the permanent magnet **814** due to the alternating magnetic induction field. The eddy currents heat the steam in both the first steam plate **110** and the second steam plate **120** from the third temperature to the fourth temperature greater than the third temperature. That is, the steam press system **100** may provide an additional heating arrangement incorporated in the first steam plate **110** and the second steam plate **120**, implementing the electromagnetic coil **810**, the alternating current circuit **812** and the permanent magnet **814** to further heat (superheat) the steam to the fourth temperature, if required.

In another embodiment, as illustrated in FIG. **8**B, the steam press system **100** may include a first resistive heater **820** located within the first middle region **714** and a first resistive heating circuit **822** (schematically shown) connected to the first resistive heater **820**. The first resistive heating circuit **822** is configured to increase the third temperature of the steam to a temperature setpoint value. Further, the steam press system **100** may include a second resistive heater **824** located within the second middle region **724** and a second resistive heating circuit **826** (schematically shown) connected to the second resistive heater **824**. The second resistive heating circuit **826** is configured to increase the third temperature of the steam to the temperature setpoint value. Herein, the temperature setpoint value may be equal to the fourth temperature which is greater than the third temperature. That is, the steam press system **100** may provide an alternative additional heating arrangement incorporated in the first steam plate **110** and the second steam plate **120**, implementing the first resistive heater **820** and the corresponding first resistive heating circuit **822**, and the second resistive heater **824** and the corresponding second resistive heating circuit **826**, to further heat (superheat) the steam to the fourth temperature, if required.

FIG. **9** illustrates a flowchart of a method **900** of recycling steam in the steam press system **100**. Further, it may be appreciated that the steps described in reference to the method **900** are only illustrative, and other alternatives may also be provided where one or more steps are re-ordered, one or more steps are added, or one or more steps are removed without departing from the spirit and the scope of the present disclosure. The steps of the method **900** are described with reference to FIG. **1** through FIG. **8**B.

At step **902**, the method **900** includes receiving recycled steam, from the first pump **210** connected to the first steam plate outlet **110***b* and the second steam plate outlet **120***b*, into the first heat exchanger inlet port **220***a*. That is, in the steam press system **100**, the first pump **210** draws the steam from the first steam plate **110** (through the corresponding first steam plate outlet **110***b*) and the second steam plate **120** (through the corresponding second steam plate outlet **120***b*) via the first piping arrangement **140**. The first pump **210** receives the rejected steam at the first pump inlet **210***a*, increases pressure of the steam and expels the pressurized steam at the first pump outlet **210***b*. The pressurized steam is directed to the heat exchanger **220** via the first heat exchanger inlet port **220***a*.

At step **904**, the method **900** includes pumping, with the second pump **230** connected to the freshwater source, fresh water at a first temperature into the second heat exchanger inlet port **220***b*. That is, the second pump **230** pumps the fresh water at the first temperature from the freshwater source into the heat exchanger **220** via the second heat exchanger inlet port **220***b*. In some embodiments, the water level sensor **222** located inside the heat exchanger **220** may be used to detect the level of the water inside the heat exchanger **220**, and the second pump **230** pumps the fresh water inside the heat exchanger **220** based on the detected level of the water inside the heat exchanger **220**.

At step **906**, the method **900** includes expelling the recycled steam from the swirl generator **510** connected to the first heat exchanger inlet port **220***a*, thus imparting the swirling flow in the fresh water which mixes the recycled steam with the fresh water, generating mixed water having the second temperature higher than the first temperature. In the heat exchanger **220**, each pipe arm **512** receives steam from the swirl generator **510** (as received from its connection with the first pump outlet **210***b*) and expels steam into the freshwater present in the housing **502** from the respective bend **514**. The expelling of the steam may generate opposing force, which rotates each pipe arm **512** around the central axis (due to the rotatable bearings), such that the swirling flow is generated in the freshwater to cause enhanced mixing of the steam into the freshwater.

At step **908**, the method **900** includes pumping, with the third pump **240**, the mixed water at the second temperature from the heat exchanger outlet port **220***c* to the storage tank **250**. That is, the third pump **240** transfers the heated water from the heat exchanger **220** through the heat exchanger outlet port **220***c* to the storage tank inlet **250***a*, to be stored in the storage tank **250**. The storage tank **250** stores the heated water at the second temperature. Further, the check valve **252** may prevent backflow of the heated water from the storage tank **250**.

At step **910**, the method **900** includes pumping, with the fourth pump **260**, the mixed water at the second temperature to the steam generator **270**. That is, the fourth pump **260** transfers the stored heated water from the storage tank **250** through the storage tank outlet **250***b*, to the steam generator **270** via the steam generator inlet **270***a*.

At step **912**, the method **900** includes heating, by providing power to the resistive heating element **274** located in the steam generator **270**, the mixed water at the second temperature to boiling, generating steam at the third temperature. The resistive heating element **274** may be the part of the steam generator heating circuit **272** to control heat being supplied in the steam generator **270**, as required to boil the heated water to generate the steam at the third temperature. The power switch **275** may be used to control switching ON and OFF the steam generator **270**. Further, the temperature control circuit **276** may be used to regulate the resistive heating element **274** to heat the water generating steam with up to the defined third temperature.

At step **914**, the method **900** includes delivering, by the controllable pressure valve **278**, the steam at the third temperature to the first steam plate inlet **110***a* and a second steam plate inlet **120***a*. That is, the controllable pressure valve **278** is used to regulate flow of the steam by controlling the pressure of the steam (from the third pressure) being supplied to the first steam plate **110** (through the corresponding first steam plate **110**) and the second steam plate **120** (through the corresponding second steam plate inlet **120***a*).

Although not illustrated through steps in FIG. **9**, the method **900** further includes pressing the first foot pedal **130** to actuate the controllable pressure valve **278** to deliver steam to the first steam plate inlet **110***a* and the second steam plate inlet **120***a*. The method **900** further includes heating, by resistive heating or inductive heating (as described in reference to FIGS. **8**A and **8**B), the steam within the first steam plate **110** and the second steam plate **120** to the fourth temperature higher than the third temperature. The method **900** further includes pressing the second foot pedal **132** to actuate the first pump **210** to evacuate the steam from the first steam plate outlet **110***b* and the second steam plate outlet **120***b*. The method **900** further includes pumping, by the first pump **210**, the steam into the first heat exchanger inlet port **220***a* to recycle the steam.

Referring to FIG. **10**, a flowchart of a method **1000** of controlling steam generation in the steam press **100** is illustrated. Further, it may be appreciated that the steps described with reference to the method **1000** are only illustrative, and other alternatives may also be provided where one or more steps are re-ordered, one or more steps are added, or one or more steps are removed.

At step **1002**, the method **1000** includes pumping recycled steam from the first pump **210** connected to the first steam plate outlet **110***b* and the second steam plate outlet **120***b*, into the first heat exchanger inlet port **220***a*.

At step **1004**, the method **1000** includes pumping, by the second pump **230**, fresh water at the first temperature, into the second heat exchanger inlet port **220***b*.

At step **1006**, the method **1000** includes mixing the steam with fresh water at the first temperature in the heat exchanger **220** with the recycled steam by the swirl generator **510**, generating mixed water at the second temperature higher than the first temperature.

At step **1008**, the method **1000** includes pumping, by the third pump **240**, the mixed water through the check valve **252** into the storage tank **250**.

At step **1010**, the method **1000** includes pumping, by the fourth pump **260**, the mixed water from the storage tank **250** into the steam generator **270**.

At step **1012**, the method **1000** includes heating, by providing power to the resistive heating element **274** of the steam generator heating circuit **272** located in the steam generator **270**, the mixed water at the second temperature to boiling, thus generating steam at the third temperature.

At step **1014**, the method **1000** includes pressing the first foot pedal **130** to actuate the controllable pressure valve **278** located at the steam generator outlet **270***b*, to deliver the steam at the third temperature to the first steam plate inlet **110***a* and the second steam plate inlet **110***b*.

At step **1016**, the method **1000** includes heating, by resistive heating or inductive heating, the steam within the first steam plate **110** and the second steam plate **120** to the fourth temperature higher than the third temperature.

At step **1018**, the method **1000** includes pressing the second foot pedal **132** to actuate the first pump **210** to evacuate the steam from the first steam plate outlet **110***b* and the second steam plate outlet **120***b*.

At step **1020**, the method **1000** includes measuring the first, second, third and fourth temperatures with first, second, third and fourth temperature sensors **284**, **294**, **288**, **296** respectively.

At step **1022**, the method **1000** includes measuring, by the first pressure sensor **280** and the second pressure sensor **282** connected between the first steam plate outlet **110***b* and the first pump **210**, the third pressure sensor **286** located at the steam generator outlet **270***b*, the fourth pressure sensor **290** located at the second heat exchanger inlet port **220***b* and the fifth pressure sensor **292** located at the heat exchanger outlet port **220***c*, a first, second, third, fourth and fifth pressure respectively.

At step **1024**, the method **1000** includes measuring, by the ultrasonic water level sensor **222**, a water level reading in the heat exchanger **220**.

At step **1026**, the method **1000** includes controlling the steam generation and recycling of the steam, by the controller **400** connected to the first, second, third and fourth temperature sensors **284**, **294**, **288**, **296**, the first, second, third, fourth and fifth pressure sensors **280**, **282**, **286**, **290**, **292**, the ultrasonic water level sensor **222**, the controllable pressure valve **278**, and the steam generator heating circuit **272**. The controller **400** includes a non-transitory computer readable medium having instructions stored therein that, when executed by one or more processors, cause the one or more processors to perform the following steps (hereinafter described to be performed by the controller **400** itself). The controller **400** monitors the water level reading in the heat exchanger **220**. The controller **400** compares the water level to a water level threshold. The controller **400** monitors the first, second, third, and fourth temperatures. The controller **400** monitors the first, second, third, fourth and fifth pressures. The controller **400** compares the first, second, third, and fourth temperatures to the first set of temperature setpoint values. The controller **400** compares the first, second, third, fourth and fifth pressures to the second set of pressure setpoint values. The controller **400** generates control signals to adjust the first pump, the second pump, the third pump, the fourth pump, the controllable pressure valve, and a power supplied to the steam generator heating circuit to generate steam matching the first set of temperature setpoint values and the second set of pressure setpoint values. In particular, the controller **400** generates control signals to adjust the first pump **210**, the second pump **230**, the third pump **240**, the fourth pump **260**, the controllable pressure valve **278**, and the power supplied to the steam generator heating circuit **272** to cause the first, second, third, and fourth temperatures to match the first set of temperature setpoint values and the first, second, third, fourth and fifth pressures to match the second set of pressure setpoint values. That is, the controller **400** may adjust (control) the said components to regulate the first, second, third, and fourth temperatures, and the first, second, third, fourth and fifth pressures based on the corresponding setpoint values as preset by the user.

The steam press system **100** implements the steam generator **270**, with the resistive heating element **274** inserted into the steam generator **270**, for boiling the water to deliver the steam to ironing station including the first steam plate **110** and the second steam plate **120**. Further, the first pump **210** acts as a suction source to take out moisture and rejected steam from ironed clothes placed between the first steam plate **110** and the second steam plate **120**. The heat exchanger **220** is used to exchange heat between the waste steam and the incoming fresh water to heat up the water before being passed to the steam generator **270**. In the heat exchanger **220**, the heat transfer takes place between the fresh water and the rejected steam, leading to increased water temperature and condensation of the steam. The free-rotating, direct-contact swirl generator **510** is designed to condense steam and heat fresh water efficiently in the heat exchanger **220**. Thus, the steam press system **100** helps to recover the heat energy in the rejected steam to heat the fresh water before entering the steam generator **270**, so that the pre-heated water in the steam generator **270** may require less energy to produce steam. Furthermore, the rejected steam is captured and recycled in the steam press system **100** which, in addition to lowering the energy consumption needed to heat the water, may lead to a significant reduction in water use. The steam plates **110**, **120** with complementary design to include the extensions **716** and the groove **726** may help to prevent the escape of the steam to the surrounding environment, which improves the working environment of the ironing shop and reduces the required power for the air-conditioning system inside the shops. Further, water level control, temperature control and pressure control is integrated into the steam press system **100** for efficient steam generation and reclamation. Therefore, the steam press system **100** advances the performance of the prior art steam generators in providing heat and mass recovery. Such a supplementary recovery system helps in utilizing the latent and sensible heat of the waste steam to increase the inlet temperature of the fresh water and hence reduce the power consumption of the steam generator **270** and may also help to reduce its size. Moreover, the steam press system **100** also reduces the water consumption by recirculating the condensed water again to the steam generator **270**.

Next, further details of the hardware description of the controller **400** of FIG. **4** according to exemplary embodiments is described with reference to FIG. **11**. In FIG. **11**, the controller **400** is embodied a computing device which includes a CPU **1101** which performs the processes described above/below. The process data and instructions may be stored in the memory **1102**. These processes and instructions may also be stored on a storage medium disk **1104** such as a hard drive (HDD) or portable storage medium or may be stored remotely.

Further, the claims are not limited by the form of the computer-readable media on which the instructions of the inventive process are stored. For example, the instructions may be stored on CDs, DVDs, in FLASH memory, RAM, ROM, PROM, EPROM, EEPROM, hard disk or any other information processing device with which the computing device communicates, such as a server or computer.

Further, the claims may be provided as a utility application, background daemon, or component of an operating system, or combination thereof, executing in conjunction with CPU **1101**, **1103** and an operating system such as Microsoft Windows 7, Microsoft Windows 10, UNIX, Solaris, LINUX, Apple MAC-OS, and other systems known to those skilled in the art.

The hardware elements in order to achieve the computing device may be realized by various circuitry elements, known to those skilled in the art. For example, CPU **1101** or CPU **1103** may be a Xenon or Core processor from Intel of America or an Opteron processor from AMD of America, or may be other processor types that would be recognized by one of ordinary skill in the art. Alternatively, the CPU **1101**, **1103** may be implemented on an FPGA, ASIC, PLD or using discrete logic circuits, as one of ordinary skill in the art would recognize. Further, CPU **1101**, **1103** may be implemented as multiple processors cooperatively working in parallel to perform the instructions of the inventive processes described above.

The controller **400** in FIG. **11** also includes a network controller **1106**, such as an Intel Ethernet PRO network interface card from Intel Corporation of America, for interfacing with network **1160**. As can be appreciated, the network **1160** can be a public network, such as the Internet, or a private network such as an LAN or WAN network, or any combination thereof and can also include PSTN or ISDN sub-networks. The network **1160** can also be wired, such as an Ethernet network, or can be wireless such as a cellular network including EDGE, 3G and 4G wireless cellular systems. The wireless network can also be WiFi, Bluetooth, or any other wireless form of communication that is known.

The computing device further includes a display controller **1108**, such as a NVIDIA GeForce GTX or Quadro graphics adaptor from NVIDIA Corporation of America for interfacing with display **1110**, such as a Hewlett Packard HPL2445w LCD monitor.

A sound controller **1120** is also provided in the computing device such as Sound Blaster X-Fi Titanium from Creative, to interface with speakers/microphone **1122** thereby providing sounds and/or music.

The general purpose storage controller **1124** connects the storage medium disk **1104** with communication bus **1126**, which may be an ISA, EISA, VESA, PCI, or similar, for interconnecting all of the components of the computing device. A description of the general features and functionality of the display **1110**, the display controller **1108**, storage controller **1124**, network controller **1106**, and the sound controller **1120** is omitted herein for brevity as these features are known.

The exemplary circuit elements described in the context of the present disclosure may be replaced with other elements and structured differently than the examples provided herein. Moreover, circuitry configured to perform features described herein may be implemented in multiple circuit units (e.g., chips), or the features may be combined in circuitry on a single chipset.

The above-described hardware description is a non-limiting example of corresponding structure for performing the functionality described herein.

Obviously, numerous modifications and variations of the present disclosure are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

The invention claimed is:

1. A steam press system, comprising:

a first steam plate configured to receive steam at a first steam plate inlet and evacuate the steam through a first steam plate outlet;

a second steam plate configured to receive steam at a second steam plate inlet and evacuate the steam through a second steam plate outlet;

a first piping arrangement connected to the first steam plate outlet and the second steam plate outlet;

a first pump connected to the first piping arrangement, the first pump configured to draw steam from the first piping arrangement and expel the steam at a first pump outlet;

a heat exchanger having a first heat exchanger inlet port connected to the first pump outlet;

a second pump configured to pump fresh water at a first temperature from a freshwater source into a second heat exchanger inlet port;

wherein the heat exchanger is configured to condense the steam into the fresh water and heat the fresh water to a second temperature greater than the first temperature;

a heat exchanger outlet port configured to expel the heated water;

a third pump connected to the heat exchanger outlet port;

a storage tank inlet connected to the third pump;

a fourth pump connected to a storage tank outlet;

a steam generator having a steam generator inlet connected to the fourth pump, the steam generator configured to:

receive the heated water at the second temperature from the fourth pump,

boil the heated water to generate steam at a third temperature; and

deliver the steam to the first steam plate inlet and the second steam plate inlet through a second piping arrangement.

2. The steam press system of claim 1, the heat exchanger further comprising:

a cylindrical insulated housing;

a plurality of supports connected at each end to opposite walls of an interior of the cylindrical insulated housing, each support having a circular opening at a central location, wherein each circular opening includes a rotatable bearing;

a swirl generator inserted through the first heat exchanger inlet port and through the rotatable bearings, the swirl generator connected to the first pump outlet, the swirl generator configured to extend coaxially with a central axis of the cylindrical insulated housing; and

a plurality of pipe arms located on the swirl generator, each pipe arm ending in a 90 degree bend, wherein each pipe arm is configured receive steam from the swirl generator and expel steam into the fresh water, such that a swirling flow is generated in the freshwater and rotates each pipe arm around the central axis.

3. The steam press system of claim 1, wherein the first piping arrangement comprises:

a first hose coupling, the first hose coupling configured with a flexible joint, the flexible joint configured to bend at an angle in the range of zero degrees to 90 degrees;

a first flexible hose connected between the first steam plate outlet and the first hose coupling;

a second hose coupling configured with a 90 degree bend;

a second flexible hose connected between the second steam plate outlet and the second hose coupling;

a third hose coupling having a T shape;

a first rigid pipe connected between a first T joint of the third hose coupling and the first hose coupling;

a second rigid pipe connected between a second T joint of the third hose coupling and the second hose coupling;

a third rigid pipe connected to a main joint of the third hose coupling;

a fourth hose coupling configured with a 90 degree bend, wherein the third rigid pipe is connected to the fourth hose coupling;

a fourth rigid pipe connected to the fourth hose coupling;

a fifth hose coupling configured with a 90 degree bend, wherein the fourth rigid pipe is connected to the fifth hose coupling;

a fifth rigid pipe connected to the fifth hose coupling;

a sixth hose coupling having a T shape, a first T joint of the sixth hose coupling connected to the fifth rigid pipe;

a sixth rigid pipe connected to a second T joint of the sixth hose coupling;

a seventh hose coupling having a T shape, a first T joint of the seventh hose coupling connected to the sixth rigid pipe;

a seventh rigid pipe connected to a second T joint of the seventh hose coupling;

an eighth hose coupling having a 90 degree bend, the eighth hose coupling connected to the seventh rigid pipe;

a third flexible hose connected between the eighth hose coupling and the first pump;

a first pressure sensor coupled to the sixth rigid pipe;

a second pressure sensor coupled to the seventh rigid pipe;

an eighth rigid pipe connected to a main joint of the sixth hose coupling;

a ninth hose coupling having a 90 degree bend;

a ninth rigid pipe connected to the ninth hose coupling;

a tenth hose coupling having a 90 degree bend, the tenth hose coupling connected to the ninth rigid pipe;

a tenth rigid pipe connected to the tenth hose coupling and a main joint of the seventh hose coupling; and

a first temperature sensor coupled to the ninth rigid pipe.

4. The steam press system of claim **3**, the second piping arrangement comprising:

an eleventh hose coupling, the eleventh hose coupling configured with a flexible joint, the flexible joint configured to bend at an angle in the range of zero degrees to 90 degrees;

a fourth flexible hose connected between the first steam plate inlet and the eleventh hose coupling;

a twelfth hose coupling configured with a 90 degree bend;

a fifth flexible hose connected between the second steam plate inlet and the twelfth hose coupling;

a thirteenth hose coupling having a T shape;

an eleventh rigid pipe connected between a first T joint of the thirteenth hose coupling and the eleventh hose coupling;

a twelfth rigid pipe connected between a second T joint of the thirteenth hose coupling and the twelfth hose coupling;

a thirteenth rigid pipe connected to a main joint of the thirteenth hose coupling;

a fourteenth hose coupling configured with a 90 degree bend, wherein the fourteenth rigid pipe is connected to the fourteenth hose coupling;

a sixth flexible hose connected between the fourteenth hose coupling and the steam generator;

a third pressure sensor coupled to the thirteenth rigid pipe; and

a third temperature sensor connected to the thirteenth rigid pipe.

5. The steam press system of claim **4**, wherein the first flexible hose, the second flexible hose, the third flexible, the fourth flexible hose, the fifth flexible hose and the sixth flexible hose are high temperature, high pressure hoses.

6. The steam press system of claim **1**, wherein the first steam plate includes a first inner surface which faces a second inner surface of the second steam plate, wherein the first inner surface and the second inner surface each include a pattern of holes distributed evenly across thereof, wherein each hole is configured to expel steam.

7. The steam press system of claim **6**, further comprising:

an outer case, wherein the heat exchanger, the first water pump, the storage tank, and the steam generator are enclosed within the outer case;

two struts each having a first end and a second end;

wherein the first end of each strut is connected to the first steam plate;

wherein the second end of each strut is connected to the outer case by a pivot, such that the first steam plate is configured to be raised above the outer case or lowered to mate with the second steam plate;

wherein the second steam plate is rigidly fixed to the outer case;

wherein the second steam plate is below the first steam plate;

a first foot pedal configured to release steam from the steam generator; and

a second foot pedal configured to operate the first pump to evacuate the steam from the first steam plate outlet and the second steam plate outlet.

8. The steam press system of claim **6**, wherein the first inner surface and the second inner surface are made from iron.

9. The steam press system of claim **8**, further comprising:

a first steam plate housing having the first inner surface, a top cover, and a first middle region, wherein the top cover includes extensions around its circumference which protrude past the first inner surface;

an electromagnetic coil located within the first middle region;

an alternating current circuit connected to the electromagnetic coil, wherein the electromagnetic coil generates an alternating magnetic induction field when the alternating current is applied;

a second steam plate housing having the second inner surface, a bottom cover and a second middle region, wherein the second inner surface has a groove around its circumference, the groove configured to receive the extensions of the first steam plate housing;

a permanent magnet located within the second middle region, wherein eddy currents generated in the permanent magnet due to the alternating magnetic induction field, heat the steam in both the first steam plate and the second steam plate from the third temperature to a fourth temperature greater than the third temperature.

10. The steam press system of claim **6**, wherein the first inner surface and the second inner surface are made from one of iron, anodized aluminum, titanium alloy, stainless steel, porcelain, satin aluminum, polished aluminum, ceramic, and titanium.

11. The steam press system of claim **10**, further comprising:

a first steam plate housing having the first inner surface, a top cover, and a first middle region, wherein the top cover including extensions around its circumference which protrude past the first inner surface;

a first resistive heater located within the first middle region;

a first resistive heating circuit connected to the first resistive heater, the first resistive heating circuit configured to increase the third temperature of the steam to a temperature setpoint value;

a second steam plate housing having the second inner surface, a bottom cover and a second middle region, wherein the second inner surface has a groove around its circumference, the groove configured to receive the extensions of the first steam plate housing;

a second resistive heater located within the second middle region; and

a second resistive heating circuit connected to the second resistive heater, the second resistive heating circuit configured to increase the third temperature of the steam to the temperature setpoint value.

12. The steam press system of claim **1**, further comprising:

a first temperature sensor connected between the first steam plate outlet and the first pump;

a third temperature sensor located at a steam generator outlet;

a first pressure sensor and a second pressure sensor connected between the first steam plate outlet and the first pump;

a third pressure sensor located at the steam generator outlet;

a fourth pressure sensor located at the second heat exchanger inlet port;

a fifth pressure sensor located at the heat exchanger outlet port;

a second temperature sensor located at the heat exchanger outlet port;

a fourth temperature sensor located in at least one of the first steam plate and the second steam plate;

a steam generator heating circuit located within the steam generator;

a check valve connected between the heat exchanger outlet port and the storage tank inlet;

a controllable pressure valve connected between the steam generator outlet and the first steam plate inlet and the second steam plate inlet;

a controller connected to the first temperature sensor, the second temperature sensor, the third temperature sensor, the fourth temperature sensor, the first pressure sensor, the second pressure sensor, the third pressure sensor, the fourth pressure sensor, the fifth pressure sensor, the controllable pressure valve, and the steam generator heating circuit, the controller including a non-transitory computer readable medium having instructions stored therein that, when executed by one or more processors, cause the one or more processors to:

monitor the first, second, third, and fourth temperatures;

monitor the first, second, third, fourth and fifth pressures;

compare the first, second, third, and fourth temperatures to a first set of temperature setpoint values;

compare the first, second, third, fourth and fifth pressures to a second set of pressure setpoint values; and

generate control signals to adjust the first pump, the second pump, the third pump, the fourth pump, the controllable pressure valve, and a power supplied to the steam generator heating circuit to the first set of temperature setpoint values and the second set of pressure setpoint values.

13. The steam press system of claim **12**, further comprising:

an outer case, wherein the heat exchanger, the first water pump, the storage tank, and the steam generator are enclosed within the outer case, wherein the outer case includes:

a first foot pedal configured to control the flow of steam from the steam generator into the first steam plate inlet and the second steam plate inlet;

a second foot pedal configured to eject the steam through the holes in the first inner surface and the second inner surface;

a temperature control switch configured to change the first set of temperature setpoint values; and

a pressure control switch configured to change the second set of pressure setpoint values.

14. The steam press system of claim **12**, wherein the steam generator heating circuit includes at least one steam generator heating element, a power switch, and a temperature control circuit, wherein the controller is configured to control the power supplied to the at least one steam generator heating element to control the temperature and pressure within the steam generator.

15. The steam press system of claim **12**, further comprising:

a water level sensor located inside the heat exchanger, the water level sensor configured to detect a level of the water inside the heat exchanger and generate a water level reading,

wherein the controller is connected to the water level sensor to receive the water level reading; and

wherein the controller is configured to adjust a power supplied to the first pump based on the water level reading.

16. The steam press system of claim **1**, wherein the storage tank is configured to store the heated water at the second temperature.

17. The steam press system of claim **1**, further comprising:

a check valve located between the third pump and the storage tank inlet, wherein the check valve is configured to prevent backflow of the heated water from the storage tank.

18. A method of recycling steam in a steam press, comprising:

receiving recycled steam, from a first pump connected to a first steam plate outlet and a second steam plate outlet, into a first heat exchanger inlet port;

pumping, with a second pump connected to a freshwater source, fresh water at a first temperature into a second heat exchanger inlet port;

expelling the recycled steam from a swirl generator connected to the first heat exchanger inlet port, thus imparting a swirling flow in the fresh water which mixes the recycled steam with the fresh water, generating mixed water having a second temperature higher than the first temperature, the second temperature in a range of 90 degrees to 100 degrees;

pumping, with a third pump, the mixed water at the second temperature from a heat exchanger outlet port to a storage tank;

pumping, with a fourth pump, the mixed water at the second temperature to a steam generator;

heating, by providing power to a resistive heating element located in the steam generator, the mixed water at the second temperature to boiling, generating steam at third temperature; and

delivering, by a controllable pressure valve, the steam at the third temperature to a first steam plate inlet and a second steam plate inlet.

19. The method of claim **18**, further comprising:

pressing a first foot pedal to actuate the controllable pressure valve to deliver steam to the first steam plate inlet and the second steam plate inlet;

heating, by resistive heating or inductive heating, the steam within the first steam plate and the second steam plate to a fourth temperature higher than the third temperature;

pressing a second foot pedal to actuate the first pump to evacuate the steam from a first steam plate outlet and a second steam plate outlet; and

pumping, by the first pump, the steam into the first heat exchanger inlet port to recycle the steam.

20. A method of controlling steam generation in a steam press, comprising:

pumping recycled steam from a first pump connected to a first steam plate outlet and a second steam plate outlet, into a first heat exchanger inlet port;

pumping, by a second pump, fresh water at a first temperature, into a second heat exchanger inlet port;

mixing the steam with fresh water at the first temperature in the heat exchanger with the recycled steam by a swirl generator, generating mixed water at a second temperature higher than the first temperature;

pumping, by a third pump, the mixed water through a check valve into a storage tank;

pumping, by a fourth pump, the mixed water from the storage tank into a steam generator;

heating, by providing power to a resistive heating element of a steam generator heating circuit located in the steam generator, the mixed water at the second temperature to boiling, thus generating steam at a third temperature;

pressing a first foot pedal to actuate a controllable pressure valve located at the steam generator outlet, to deliver the steam at the third temperature to a first steam plate inlet and a second steam plate inlet;

heating, by resistive heating or inductive heating, the steam within the first steam plate and the second steam plate to a fourth temperature higher than the third temperature;

pressing a second foot pedal to actuate the first pump to evacuate the steam from the first steam plate outlet and the second steam plate outlet;

measuring the first, second, third and fourth temperatures with first, second, third and fourth temperature sensors respectively;

measuring, by a first pressure sensor and a second pressure sensor connected between the first steam plate outlet and the first pump, a third pressure sensor located at the steam generator outlet, a fourth pressure sensor located at the second heat exchanger inlet port and a fifth pressure sensor located at the heat exchanger outlet port, a first, second, third, fourth and fifth pressure respectively;

measuring, by an ultrasonic water level sensor, a water level reading in the heat exchanger;

controlling the steam generation and recycling of the steam, by a controller connected to the first, second, third and fourth temperature sensors, the first, second, third, fourth and fifth pressure sensors, the ultrasonic water level sensor, the controllable pressure valve, and the steam generator heating circuit, the controller including a non-transitory computer readable medium having instructions stored therein that, when executed by one or more processors, cause the one or more processors to:

monitor the water level reading in the heat exchanger;

compare the water level to a water level threshold;

monitor the first, second, third, and fourth temperatures;

monitor the first, second, third, fourth and fifth pressures;

compare the first, second, third, and fourth temperatures to a first set of temperature setpoint values;

compare the first, second, third, fourth and fifth pressures to a second set of pressure setpoint values; and

generate control signals to adjust the first pump, the second pump, the third pump, the fourth pump, the controllable pressure valve, and a power supplied to the steam generator heating circuit to generate steam matching the first set of temperature setpoint values and the second set of pressure setpoint values.

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